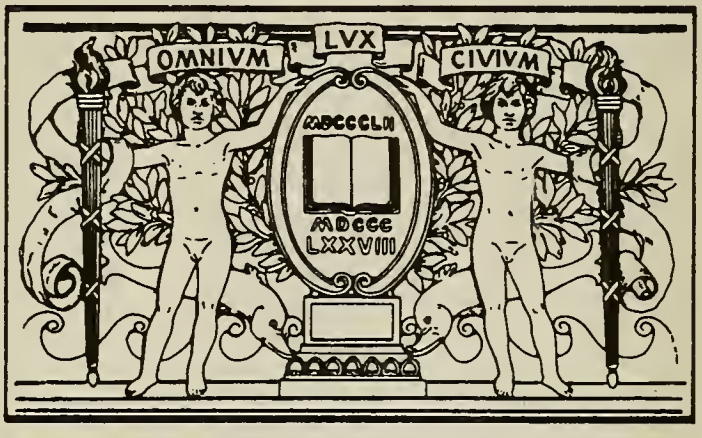


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JOURNEY TO ARARAT.

BY

DR. FRIEDRICH PARROT,

PROFESSOR OF NATURAL PHILOSOPHY IN THE UNIVERSITY OF DORPAT, RUSSIAN IMPERIAL COUNCILLOR OF STATE, KNIGHT OF THE ORDER OF ST. ANNE, ETC.

With Map and Wood Cuts.

TRANSLATED

BY W. D. COOLEY.

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PREFACE.

THERE is no study more delightful or practically more useful than that which makes us acquainted with the earth and its inhabitants. It leads us into the widest field of observation, where we not only see all the phenomenon of nature, but may also, under good guidance, learn their laws, and the most advantageous modes of contemplating them. This systematic application of physical science to geography has made great progress of late years. The brilliant example set by M. Alexander von Humboldt has incited many accomplished men to explore the different quarters of the globe for the purpose of scientific inquiry. Travelling was with them an intellectual pursuit, and a pleasure of the highest order. It was impossible for the rulers of society to remain unaffected by an impulse originating in the progress of knowledge. The chief European states have despatched, in the present century, numerous expeditions to explore and to make collections in the various departments of Natural History. Some of the individuals who were thus employed rank among

the most eminent scientific men of the present day.

Yet the history and results of these expeditions are by no means generally known either in Great Britain or the United States. Of the narratives of scientific voyages and travels published abroad, comparatively few, and those only the most trivial, are ever translated into English. Though replete with matter of the most interesting kind, yet they are generally either too cumbrous in style or too voluminous to suit a people with whom habits of business have generated a distaste for whatever seems pedantic or prolix. Their attractiveness thus escapes notice, and a large mine of valuable information, practical as well as scientific, remains inaccessible to the English reader.

The interest attaching to the first ascent of Mount Ararat is acknowledged by all; nor will it be likely to be diminished by the partial fall of that mountain in 1840 (of which an account is given in the Appendix), when the very monastery in which M. Parrot had resided, and the ancient village of Arghuri, with the vineyards, traditionally believed to have been planted by Noah, were overwhelmed and totally destroyed by the ruins from above.

The result of the late M. Parrot's scientific investigations are here given complete, but the

figures and formulæ with which they were accompanied have been retrenched, so that this part of the work is reduced to one fourth of its original bulk. On the determination of one physico-geographical problem of great importance—the relative level of the Caspian Sea—M. Parrot exercised, by observation and discussion, the greatest influence. His papers on this subject are therefore given at length, and a short account of the definitive settlement of the question is added in the Appendix.

When MM. Engelhardt and Parrot published an account of their travels in Caucasus in 1811, the work was very favourably received by the learned throughout Europe. The ascent, nevertheless, of some of the summits of Caucasus, as related by those travellers, was pronounced *impossible* by Klaproth, who visited the same country a few years later. This impossibility, however, has been since repeatedly performed.

In like manner, the fact of M. Parrot's ascending Ararat has been denied, because, it is alleged, the summit of that mountain is a cone of steep ice, and the ascent of it is impossible. But examples of reputed impossibilities of this kind, achieved by men urged on by scientific curiosity, and stimulated by the struggle with difficulty and danger, are so numerous, that we are only at a loss how to reply to this objection

with sufficient brevity. Ararat, though high, is yet inferior in altitude to many of the passes of the Himâleh: its icy head may be steep; but yet, that resolute men can climb the narrowest ridge of the steepest ice, was proved in the ascent of the Jungfrau by M. Agassiz, Mr. Forbes, and others in 1841.* A Russian traveller, M. Autonomoff, is said to have ascended Ararat in 1834; and its summit was, we believe, nearly reached by Colonel Stoddart, who perished in Bokhara. There seems, therefore, to be no ground for questioning the veracity of M. Parrot, who, as a traveller as well as a philosopher, fully merited the eulogy pronounced on him by M. von Humboldt,† and was "constantly guided by the love of truth."

* Edinburgh New Philosophical Journal, 1842, vol. xxxii., p 291. † Asie Centrale, tom. ii., p. 306.

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JOURNEY TO ARARAT.

CHAPTER I.

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In an age like the present, pre-eminently active in the examination of nature, when governments lend their ample means to promote scientific expeditions, while the learned sacrifice their repose and even their lives to them, there can be no need of seeking to justify an enterprise such as that about to be recorded in the following pages. And yet there is one consideration of a peculiar kind which may be properly urged in its favour; for if the exploration of a great mountain redounds, generally speaking, to the advantage of science, and affords enjoyment to the admirer of nature—if even a bare rock or little hill, left untouched by the hand of man, affects, from a pure and simple sense of nature, the heart of the observer, what must not be the feelings of the Christian when he fixes his eyes on that sacred mountain, where all the attractions of natural grandeur, so long concealed from our view, are united to the peculiar interest of a primitive monument and witness of one of the most re-

markable events in the history of the world, and of God's immediate dispensation for the preservation of the human race!

The attainment of an object so sublime might well have been reserved for one more worthy than the individual who in this case owes the success of his efforts to a mere concurrence of favourable circumstances. The extraordinary difficulties by which any scientific researches upon Mount Ararat were beset, so long as it constituted the landmark between two states in hostility with Christendom, were sufficient to repress the ardour of many a zealous naturalist. This, indeed, had been the case with myself ever since my visit to Caucasus about twenty years before, when, as I stood upon the Kasbeg during a snow-storm, a momentary break in the clouds discovered in the distant south a high, round, solitary peak—in all probability the silver crown of Ararat.*

By the peace of Turkmanshai† the domain of Christendom was extended beyond the Araxes, and Mount Ararat became the extreme boundary of the Russian Empire on the side of Turkey and Persia. The Kurds, however, still continued their depredations on the north and south till the breaking out of the war between Russia and the Porte. The imperial eagle then soared over Ararat; the pashalik of Bayazed was invested, and those restless hordes were overawed. The time was now come for the gratification of my long-suppressed aspiration after the mysterious mountain, and a fortunate conjuncture presented me with means conducive to the object I had in view.

My ignorance of many local details necessary

* Travels in the Crimea and Caucasus, by M. von Engelhardt and Dr. Fried. Parrot, Berlin, 1815, vol. i., p. 197.

† Between Russia and Persia, 10th of Feb., 1828.

for my guidance, and anxiety lest the expected peace should restore the recent conquests to Mohammedan rule, and thus render them as insecure for Christian travellers as during open war, obliged me to limit the preparations for my journey to a supply of the most indispensable instruments, and to proceed upon the enterprise at my own expense, accompanied only by M. von Behaghel von Adlerskron, a mineralogist, and pupil of Professor Engelhardt, who was to assist also in taking levels with the barometer. So fully determined was I that nothing should divert me from my purpose, that the mere gratification of beholding the sacred mountain with the eye of a sincere Christian and inquiring traveller was enough to make me bid defiance to all the perils of a journey of 2330 miles. Meanwhile I had received a pressing solicitation from two medical students of the University, M. Julius Hehn and M. Carl Schiemann, for permission to accompany me. They proposed to employ themselves in making collections, the former in botany, the latter in zoology, both contributing their proportion of the expenses.

But the most important addition to our party was suggested by M. Struve, who resolved to avail himself of this opportunity of serving at once the interests of astronomy and those of a young astronomer, and who accordingly proposed to the authorities that M. Vassili Fedorov, student of Philosophy in the Imperial Academy, but trained as an astronomer by Professor Struve, should be permitted to join the expedition, and that the cost of the necessary instruments, as well as his share of the expenses, should be defrayed out of the imperial treasury. We should thus be in a condition not only to determine the exact position of the places visited, but also to measure trigonometrically the

height of Mount Ararat, and obtain an exact measure of time for experiments with the pendulum.

These arrangements having met with the entire concurrence of the authorities, and being communicated to his imperial majesty, had the good fortune to be favourably received, and graciously sanctioned by the following note:

"The project has my full approval. Let a feldyäger* of tried fidelity be selected to accompany the expedition, and to remain in the service of the travellers till their return."

Such were the gracious orders of the emperor. At the same time, an advance of 1600 silver rubles was made for the purchase of instruments, and to meet the expenses of the journey on the part of M. Fedorov. Two of the best chronometers were provided by the kind solicitude of Prince Lieven, minister of Public Instruction—one being bought from the Admiralty, and the other lent by the Imperial Academy of Sciences for the purposes of the expedition; while the feldyäger, in the person of a young man named Schutz, of extraordinary activity and most obliging disposition, was placed under my direction, and the whole party recommended to the patronage and protection of Count Paskevich, of Erivan, commander-in-chief in the Trans-Caucasian provinces.

To what an extent the objects of my journey were promoted by these truly paternal attentions may be best appreciated from my entire narrative; yet I may be here allowed to mention the additional marks of his majesty's favour which we experienced on our return, namely, the full reimbursement of all expenses incurred during our absence; the order of St. Anne, of the second class, confer-

* The feldyäger is a courier, or military guide.

red upon myself; the presentation of the theodolite employed on the expedition to M. Fedorov, who had used it with so much assiduity and effect; together with the surplus of 300 silver rubles remaining in our hands; and, lastly, a ring set with brilliants to our feldyäger, in acknowledgment of his intrepidity and zeal.

Neither did the hearty co-operation of our friends leave anything undone which might ensure the success of the scientific results expected from our enterprise. The most incessant exertions were made by Professors Engelhardt, Eschscholz, Ledebour, and Struve, to have their pupils prepared in the short interval that remained before our departure; nor was their farther assistance withheld upon our return. In the hope that some additional light might be thrown upon the ancient geography of the countries through which we might have to pass, I was supplied by the kindness of Professor Kruse with maps and an itinerary prepared for the purpose by himself. While thus acknowledging our obligations to the liberality of our friends, we must entreat our scientific readers to attribute whatever imperfections may be found in our work to our own want of ability, or to the inevitable difficulties with which we had in many instances to contend.

So great had been the delay occasioned by procuring the instruments required for our journey, that our departure from Dorpat did not take place till the 30th of March,* at eight in the evening. Our physical apparatus consisted chiefly of a complete pendulum apparatus, a ten-inch azimuth compass, a dipping needle, three portable barometers,

* Old style. The Julian reckoning is employed throughout the work. [The old style, which is still used in Russia, is now twelve days behind the new. The expedition started therefore, according to our reckoning, on the 11th of April.—Ed.]

and a delicate balance, all manufactured by Brücker, mathematical instrument maker to the University, and, in point of execution and accuracy of adjustment, worthy of being put into competition with the productions of the best artists in that line. This will be fully evident from a reference to the details of the physical experiments given elsewhere.

The lateness of our departure caused me much anxiety, not more on account of the loss of time than the loss of the season, inasmuch as I felt persuaded—and in this I was confirmed by subsequent experience—that, owing to geographical position and local circumstances, the early part of the spring, beginning with the month of February, must be not merely the most favourable, but even the only season for researches in natural history in countries so exposed to the scorching sun. As early even as the month of June vegetable life becomes in a manner extinct, from the combined influence of the sun's rays, and the aridity of the atmosphere and soil: the plains and mountain sides, being destitute of both wood and water, have no covering but a scanty and burnt herbage, the roots of which are so rarely visited by a refreshing shower that the reparatory power of nature is all but lost, while the active animal kingdom seeks protection against the heat and drought either by burrowing in the earth, or retiring to the cool and inaccessible retreats in Caucasus and the mountains of Asia Minor.

A reduction in the number of the post-horses between Smolensko and Orel, which had just then taken place, obliged us to diverge into the road to Moscow, from whence we continued our journey southward; and now, having greater facilities for travelling, we pursued the grand post-route by Ka-

luga, Orel, Kursk, Kharkov, and Bakhmut, to New Cherkask, where we arrived, without any accident, on the 10th of May. If we had hitherto been in some measure favoured by the remains of winter, at least as far as Smolensko, we now found a greater impediment to our progress from the same cause, during the latter part of our passage through this district. It is in the governments of Smolensko and Kaluga, which form the central portion of European Russia, that most of the large rivers of the empire have their rise. From their sources in this tract, which is elevated nearly 1000 feet above the level of the sea, they discharge their waters in so many directions across the plains as to present innumerable impediments to the traveller during the period of transition from winter to spring. At this season, not only are the public roads completely broken up, but rapid rivers, which have overflowed their banks, have to be crossed either in heavy boats or rafts constructed for the purpose, by which great loss of time, fatigue, and danger are sure to be incurred; so much so, that, unless the traveller limit himself to the most simple and indispensable equipments—his personal necessaries, in fact—it is always most advisable to await the settled return of the spring.

Some interesting points upon this route could not be passed without our notice. Among these is the little town of Belef, in which the Empress Elizabeth, upon her return from southern Russia, sank and died, overcome by grief for the irreparable loss of her imperial consort, whom she was soon to follow to a better world. A touching record of this painful occurrence is presented by the house in which she expired: it is a plain stone building of two stories, and, having been subsequently purchased by the crown, is now erected into a found-

ation for twenty-four poor widows, who are provided for with comfort and respectability, though not with ostentation or parade, out of the imperial treasury. The chamber of death itself has been converted into a neat chapel for the widows, the spot on which the empress died being enclosed by a screen of oil paintings, and used as the sanctuary.

In Kaluga I had the gratification of falling in with a register of observations of the weather, kept by Dr. Wehrman, which he himself had noted down with the greatest accuracy three times a day —at 6, 2, and 10 o'clock. The tube of his barometer was four lines in diameter, well purged of air, and inverted in a wide basin below. The place of the observer was 241 English feet above the level of the Oka, on which Kaluga lies. The mean height of the barometer, at a mean temperature of 14° Réaumur (63½° Fahr.), was,

For the year	1827 - - -	29·28	English inches.
"	1828 - - -	29·30	"
"	1829 - - -	29·36	"
"	1830 - - -	29·39	"

In consequence of my observations in Dorpat, it was very interesting to me to observe that these also showed a uniform increase in the mean height of the barometer during the period here specified.

While I stayed at Kharkov, I contrived to become acquainted with the professors and scientific department of the University, and passed some time in a very agreeable manner in visiting the medical, surgical, and obstetric wards, where I heard some excellent lectures delivered. In conclusion, M. von Behaghel and myself resolved to enjoy the recreation of a visit to the neighbouring coal-mines of Nikitofska during our halt at Bakh-

mut; the coals, however, though the beds are numerous, have not been discovered in any considerable quantity.

After leaving Kharkov, we were enabled to pursue our journey without any interruption worth mentioning, travelling rapidly along the dry and firm roads, and cheered by the increasing serenity and warmth of the season. Now, too, for the first time, I felt thoroughly and vividly impressed with the idea that I had really started on my journey to Ararat. Notwithstanding this, I felt that I ought to devote a few days of the time still at my disposal to a short but interesting detour, which would lead me into the Kalmuk steppe, to the eastward of New Cherkask, for the purpose of collecting some information as to the mysterious course of the Manech, a river involving many important questions, connected with the relative levels of the Black and Caspian Seas, and in the vicinity of which, if it be true that there was once a communication between their waters, we might even still expect to discover some evident traces of this union, inasmuch as, from its low level, it must have been latest deserted by the waters.

The wide plain stretching along both sides of the Manech, from Cherkask to the borders of the Caspian, is inhabited by various tribes, but principally by Kalmuks. These latter are in exclusive possession of the western half, till we come to the boundary between the territory of the Don and the government of Astrakan: the occupation of the eastern half they are obliged to share with the Trukhmans, Karanogais, and some Armenian Christians, who are found in the steppe, leading, like its other inhabitants, a purely nomadic life. Besides, this portion of the empire is traversed by a line of Kossak posts, which succeed one another

from Cherkask, at intervals of twenty versts, or thirteen and a half English miles, following the course of the Manech, first upon its southern, and then on its northern bank, till they reach the extremity of the lake of the Manech, where they take a northerly direction along the borders of the government of Astrakhan. Of course, no regular post establishments can be supposed to be maintained here: travellers can merely proceed on horseback, either along the Kossak stations, or from one Kalmuk settlement to another. On this account I was obliged to despatch three of our company, with the instruments and baggage, in our travelling wagon, to Mosdok, by Stavropol; and, being thus unencumbered, I was enabled, with the assistance of M. von Behaghel and the guide, to proceed with the barometers directly towards the steppe.

In order to effect a passage from New Cherkask, which we left on the 10th (22d) of May, to the Manech, we had to cross the Don, which at that season, as is usually the case, had risen about twenty feet, and had so far overflowed its banks, that, what with the numerous channels into which it is divided, and the tributary waters that it receives, it formed one continuous lake of from seven to fourteen miles in breadth, in which the mouth of the Manech also had completely disappeared.

Immediately after crossing the Don we had occasion to congratulate ourselves on the hospitable reception we experienced in the hutor or estate of Protopopskaia: we were next entertained, about sixteen miles farther on the banks of the Manech, in the hutor of Balabin, belonging to two retired officers of Kossaks. From this point we followed the course of the Manech, as closely as we could, proceeding from one to another of the Kalmuk ouls (encampments) scattered over the steppe, where

we invariably and readily obtained the necessary horses and guides on presenting our papers. For the purpose of measuring the fall of the Manech throughout this entire journey, it was absolutely necessary that I should be constantly at a distance of ten or fourteen miles from my fellow-labourer, so that we might arrive each at his own station at a certain time, and after making our observations with the barometer, push forward to the next points, so as to repeat the same operations at the same moment. Our plan was to proceed thus, with an uninterrupted chain of results, as far as circumstances might permit us to advance, till we should extend them—as I first wished and expected—to the Caspian Sea, meeting only at night, when we deliberated upon our respective duties for the ensuing day. Such was the grand object of the present excursion, a detailed account of which will be found in one of the scientific memoirs appended to this work. Consequently, we had but little time or attention to bestow on other pursuits. Still, it was difficult to avoid dwelling with a feeling of interest on the national characteristics of the Kalmuks, the unsophisticated and inoffensive people of the steppe.

The Kalmuk mode of life is systematically nomadic, and to this they cling with all the tenacity of inveterate habit. What in another age and under different circumstances would have been but common necessity, has at present, when neither opportunities nor inducements can be wanting to tempt them to adopt a settled mode of life, become a keenly-felt want and a source of gratification. The peculiarities of their religious notions, language, and manners are too distinctive to justify any expectation that they could be so far influenced by the example of neighbouring nations

as to establish themselves in fixed habitations. So great is their attachment to a roving life, that I was assured by one of their priests that it would be looked upon as a sort of violation of religious principle if they were even to attempt to provide a supply of hay in summer to secure their horses and oxen from the danger of perishing of hunger in the winter, because it would seem an approximation to habits to which their national practices are too obstinately opposed.

To this I never knew but one exception, in the case of a Kalmuk prince, with whom I formed an acquaintance a year afterward in Astrakhan. This personage, whose name was Serbechab Timeniev,* and who was the chief of the Khotoutusk Uluss, or horde, had formed a regular settlement in the neighbourhood of that city. He had there built himself a house in the European style, with commodious apartments, billiard-room, kitchen, cellars, &c., and maintained a large establishment of servants, principally Kalmuks, though he had been obliged to commit the management of his stud of horses to a German by birth. The requisite outbuildings and kibitkas, together with the very tasteful Kalmuk church which he had erected, gave the whole very much the air of a nobleman's country residence, to which the frank and hospitable disposition of the owner was ever ready to welcome the respectable and well-informed stranger. The gratification I derived from this visit was still farther enhanced by my having the good fortune to encounter Professor Hansteen, of Christiania, at the prince's, upon his return from Siberia, and my own from Ararat.

Prince Timeniev had entered into the Kossak

* The same, perhaps, mentioned by Zwick in his Journey from Sarepta, Leipsig, 1827.

service—which is best suited for the Kalmuks, and in which, indeed, the common Kalmuks are bound to be enrolled—and obtained the rank of colonel. He has now retired to his residence among his countrymen to enjoy all those advantages which his intercourse with cultivated nations has taught him to appreciate, and this without throwing aside his national character, the fundamental distinctions of which are natural simplicity of manners and soundness of judgment. His treatment of his guests is marked at once by the affability of the polished man of the world and the self-possession of the native of the irreclaimable steppe. Even when he modestly offered some mark of attention, or when his thirst for knowledge induced him to put some question, the very simplicity of which was more indicative of intelligence than the conceited silence of others, he would occasionally introduce it with the remark, "Remember, Professor, I am but a Kalmuk, who has been a little in the world." Riches, elevated station, military rank, and immediate connexion with a civilized nation may in his case palliate, if not justify to the minds of his countrymen, the step he has taken; and how can we foresee what impression a number of such instances might make upon his nation? Whether such a result is to be desired is another question.

One article indispensable to the nomadic life of the Kalmuk is his kibitka, the light, portable, but durable and secure house of the steppe, which, in the space of a single hour, may be removed from the wagon, erected, and arranged for the reception of the inmates by a couple of men. A regular circle is first described upon the ground, having a diameter of about 17 feet when intended for a dwelling of the humbler class; somewhat more when designed for the kibitka of a person of high-

er rank, or for that in which their religious ceremonies are performed. Upon this area is next placed a broad piece of lattice-work, formed of flat willow rods, about the thickness of the thumb, and secured, at the points where they cross each other, with thin leathern thongs, yet in such a manner that the whole may be readily struck and rolled up, and, upon erecting it again, may be extended or contracted, in which latter case it would consequently stand higher. At the point where the two ends approach each other, a space is left, to which a light double door of thin neat boards is fitted, and where it is fastened by a strong and flat rope. A funnel-shaped skeleton roof, of long round wattles, is attached to the upper part of the upright frame by means of thongs or cords, and ends above in a circular aperture of about three feet in diameter, where it is strengthened by a firm wooden rim, having holes for the reception of the wattles of which the roof is composed. Several braces are next passed over the entire roof to ensure its perfect stability. The entire structure, roof and side walls, are now covered with unsized felt, which is made to fit accurately and smoothly by the aid of a number of straps with which it is confined. A cover of felt is likewise attached to the round opening in such a manner that it is not necessary to climb the roof when it is required to close it, as this may be readily effected by drawing a rope across. Besides this, many kibitkas may be seen with a square piece of felt suspended obliquely over this opening on a long pole, so that the occupants may be sufficiently protected from the wind or rain without closing it altogether.

In the centre of the floor is a place where the fire is made, which affords light and warmth to the entire apartment; here, too, the cooking is carried

on, and their brandy distilled. This last is an extraordinary preparation, a kind of animal spirit distilled from fermented milk, their usual beverage, in a copper vessel provided with a head and worm, from whence it is drawn for daily consumption. This liquor they call *arraca*, and when rendered purer and stronger by a second distillation, it becomes *dan*, which is a pungent, clear spirit, with a disagreeable empyreumatic flavour of the milk. Even the residuum of this distillation is carefully preserved and mixed with flour, so as to form a sort of hasty pudding, to which they give the name of *budan*. Besides this, they indulge themselves in the use of butter, which they call *kaimak ;* fermented mares' milk, *chigan*, a refreshing drink in summer ; and curdled milk of a very disgusting taste, and termed *aamdim*, which is dried in the sun upon felt-cloths, and stored up as an important article of food for the winter.

However small the relish that a European palate can have for such fare as this, the Kalmuk tea is still less inviting. This is brought from the northern provinces of China in hard, flat cakes of about an inch in thickness, and consists either of the old and tough leaves of the tea-tree, or possibly of those of very different shrubs, though it always has, when drunk alone, something of the appearance and flavour of genuine tea. A portion of this, as may be required, is cut off and dissolved in boiling water, to which some butter, fat, and salt are added, and, after removing the soft mass of leaves, the infusion is drunk as a sort of soup, either with or without milk, in respect to which they are totally indifferent whether it be fresh or sour, as their custom is to keep it in very filthy wooden dishes or pails in their close and smoky kibitkas, to be used by all the members of the family when and

how they will. If to these articles of diet we add the flesh of their cattle, especially the sheep, which they eat boiled, roasted, and baked, we shall obtain a tolerably fair idea of the requisites of a Kalmuk larder.

At the same time, it cannot but appear surprising that a race so primitive and inoffensive should confine themselves exclusively to an animal diet; for even the very flour necessary for household consumption is only to be procured, in exceedingly small quantities, by a disadvantageous barter with the Russians. The Kalmuks make no use whatever of vegetables, the herbs of the steppe, or fruits; probably because their production in sufficient abundance might impose upon them the necessity of attending to the cultivation of the soil, and this, were it only for a single season, might interfere with the independence of their roving life. Their only concern is their flocks and herds, which they find adequate to the supply of all their wants. Of the hair or fleeces they make cushions, felt-cloth, ropes, and lines; the skins they convert into articles of dress, or use as coverlets, while the leather, which is rudely dressed with fermented milk and lime, serves them under a variety of forms, in the construction of their kibitkas, harness for their cattle, and in the formation of canteens of every size, called *berba*, made of leather pressed. The milk supplies them with brandy and materials for tanning, the flesh with food, and the dung even furnishes them with fuel. It is also by means of his flocks and herds that the Kalmuk contrives to provide himself with linen cloth, cotton stuffs, salt, and meal, which he gets in exchange for camels (of the two-humped species), and horses, reared by him in considerable numbers, and which are of a light, swift, and hardy breed.

The cattle being left to graze upon the steppe in summer, and to find their living where and how they can in the winter, the life of the Kalmuk is inactive. The migration from the winter to the summer pastures constitutes the only important event in his monotonous existence. This want of all social excitements for the mind, this uniformity in his intellectual and physical life, renders it in a great degree comprehensible how a people, endowed with so many estimable qualities of mind and body, should become the votaries of the idle and fantastic religious dogmas which prevail, at least, among the hordes occupying this quarter of the steppe.*

These Kalmuks profess the religion of Buddah, which had its origin in India, but, having been superseded by the doctrines of the Brahmins, found its way into Mongolia and Tibet. It is a sort of pantheism, not at all easy to comprehend: rejecting the principle of one Almighty Being, the creator of heaven and earth, it nevertheless asserts the essential identity of God with the material world, neither placed above it, nor existing before it, but proceeding with it out of immeasurable space. Among all animated beings, of which there are good and bad, there is, according to this creed, a consecutive subordination of rank, the several gradations of which must be passed by each in long intervals of time. The highest place is that of Buddah, by whom, however, we are not to understand any individual impersonation of God, but merely the attributes of the Divine nature, which it is the destiny of every being to attain, according to the measure of his good works. This metempsychosis is to be conceived as an existence in the "tranquil ocean of illimitable space," on the shores

* Zwick's Journey from Sarepta, 1827.

of which the Buddah can alone find rest; but the attainment of this goal by works of charity is the result of the revelation, or kind of redemption, which all beings enjoy once in a thousand years, through the perfection of a Buddah, who is the ruler and benefactor of the world during the period assigned for his reign.

We should be much mistaken, however, if we were to suppose that these or any other settled notions of religion would be found universally prevailing among the hordes in the steppe of the Manech. Respecting the fundamental tenet of all religion, the belief in the existence of a Divine Being, the ideas of the generality of them would be found contradictory and unsettled. We might even detect here and there some obscure traces of intermixture with the doctrines of the Christian faith; as, for instance, the idea of the god Sengir, of whom I heard it said by some of the Kalmuks of the Manech that he was the highest of all, and born of the right side of the mother of God; a persuasion which was even avowed in my presence by Serbechab Timeniev, at Astrakhan.

But how is it possible that the Kalmuks could arrive at any fixed or just notions upon such a subject, when they not only receive no religious instruction, but are without any regular performance of religious worship, even on the Sabbath; while on their feast-days, when they are in the habit of attending the house of God, they hear nothing but the repetition of forms of prayer, and the reading of the Scriptures in a language they cannot understand, and this in conformity with a ritual which would appear to have as little meaning or attraction for the initiated as for the laity? Priests, and places dedicated to the service of religion, are not to be met with in every khatun, as these migratory

villages are called; the latter are found scattered here and there under the name of convents. These are readily discovered by the traveller even at a distance, when he remarks, on an open site, in the middle of the khatun, ten or twelve kibitkas larger and neater than the rest, which enclose a circular or oval space, but without a human being at the usual domestic occupations, or any cattle feeding. "That is a convent," was an expression that struck me forcibly the first time I heard it in the steppe. Would it not, indeed, have been a touching sight, amid the open plain, and under the vault of heaven, to behold within the enclosure of a few humble hospitable tents a building dedicated to the honour of the Deity, by an inoffensive community, on the spot where the wants of their peaceful flocks demanded their temporary abode, and where they had displayed upon it all the embellishments that the narrow circle within which their own desires were confined permitted them to bestow, could we but persuade ourselves, at the same time, that the worshippers felt the privilege to which they were admitted, in presenting the offering of a true and heartfelt devotion in the temple of their God?

Alas! how soon are such ideas dissipated upon our first entrance into the tabernacle! Here hang a number of distorted representations of their divinities on the walls; there is reverentially preserved a brazen idol, cast for their principal god, who is generally represented as a female, like many others among them, and often with four or six arms, and similar hideous deformities of shape. In another place lie piled in chests their sacred writings, obtained from Mongolia or Tibet, and which are intelligible, or rather legible, to none but the initiated—that is to say, their high priest or lama, and the officiating minister or gellong. Their religious

service, too, judging from what I had an opportunity of observing, is in no respect more elevating. The priests seat themselves in the kibitka, with their legs bent under them, and the soles of their feet turned upward, or, as the Mongolians express it, in sceptre-fashion,* so as to be ranged in two lines opposite to each other from the entrance. In this posture they remain, as immovable as statues, and chant or sing their prayers on a sort of rosary, interrupted from time to time by the harsh, discordant tones of a peculiar kind of brazen cornets, accompanied with the clang of kettle-drums and cymbals, and the deep but clear bass notes of two straight wooden trumpets six feet long; which latter, however, I only saw introduced in the elegant stone church built at Astrakhan by the Kalmuk chief whom I have already mentioned.

As for the laity of even the same khatun only taking a part in the daily worship of their gods, they are effectually precluded from that by the smallness of the kibitka in which it is performed; much less can the inmates of those khatuns which are six or twelve miles distant catch the sound even of the music. They content themselves with the assurance that the lamas and gellongs are offering up the prayers enjoined by their ritual for the welfare of the Kalmuk community. As the constitution of their Church teaches no distinction between Sundays and week-days, their prayers are limited to a short formula, which they repeat as a sort of charm or spell upon every important occurrence, and without any very clear conception of its import.

I felt an inclination, upon one occasion, to take a young Kalmuk, of thirteen years old, who had lost his father, into my service, at the earnest en-

* Compare Klaproth's Travels in Caucasus and Georgia, 1812 vol. i., p. 213, Germ. ed.

treaty of his mother and both his uncles—an arrangement which was equally agreeable to the well-disposed and intelligent youth himself, whose name was Noron. When I came to reflect, however, that there would be no one in my household to instruct him in his own religion, but that, on the contrary, many inducements might be held out to him to turn Christian, I thought it my duty to communicate this objection to his relatives: to this their reply was, that, as far as their choice went, they would wish him to continue a Kalmuk; but if God should ordain it otherwise, they would not object to his becoming a Christian. All they had to request of me was, that I would see that he did not forget his *omma nibad mækhum*, but make him repeat it every day. These poor people had even gone so far as to allow him to be taught to read Russian, by a benevolent Kossak of the neighbouring detachment, and even to say Christian prayers; a fact that must appear almost incredible to any one acquainted with the insuperable difficulties which have hitherto frustrated the zealous Christian missionaries in their exertions for the conversion of the Kalmuks.

So much for my observations upon the Kalmuks of the Manech, to whom I must now bid adieu, and prosecute my journey. This now led us along the right, or northern shore of the great lake of the Manech, by which is to be understood a considerable widening of the river Manech, about thirty-three miles in length, lying nearly midway between the Black Sea and the Caspian, and which must be crossed in boats.* At the western extrem-

* The course of the Manech will be found in the map, laid down with as much accuracy as was possible from a mere topographical survey, by Major-general Bogdarov, by whom it was kindly presented to me.

ity of this expansion, on its northern shore, are a number of salt-lakes, the largest of which, there called Grusnoe Ozero, is probably the same that is distinguished in our maps by the name of the New Salt Lake, and is five miles long, and two thirds of a mile wide. These lakes have the property, in common with others of the same kind, that, during the hottest season of the year, which in these parts is from May till the end of August, the surface of the water becomes covered with a crust of salt nearly an inch thick, which is collected with shovels into boats, and piled on the shore, where it is closely thatched over with reeds till carried away. This is managed by private individuals, who rent the privilege from the government of the Don on condition of paying a tenth of the produce.

On this occasion I was much interested in being able to prove to my own satisfaction that in such lakes it is nothing more than the rapid evaporation from the heat of the sun, and the consequent super-saturation of the water with salt, that effects the crystallization of the latter; for these lakes are so shallow, that the little boats in which the salt is gathered are generally trailing on the bottom, and leave a long furrow behind them on it; so that the lake is consequently to be regarded as a wide pan of enormous superficial extent, in which the brine can easily reach the degree of concentration required; while, on the other hand, if the summer prove cold or rainy, the superfluous water must necessarily oppose the crystallization of the salt, or even prevent it altogether.

At the eastern end of the lake of the Manech we perceived that we had already passed the middle of the tract lying between the Black and Caspian Seas. It now became impossible for us to continue our route in the same direction, at least in sep-

arate parties, according to our original intention, for it is at this point that the boundary of the territory of the Don, and with it the line of Kossak posts, turns suddenly to the north; and as for applying to the government of Astrakhan for a safe-conduct through those districts which were in the partial occupation of the Karanogais and thievish Trukhmans, it was now too late, inasmuch as I had hoped that, in case of necessity, I should be able to procure whatever assistance I might stand in need of through the general ministerial order which I had to the civil authorities on the spot. This, however, was not the case, nor under judicious arrangements can it ever be, as the subordinate officials must only comply with the arrangements of their immediate superiors, which are influenced, for the most part, by considerations of a local nature; they must consequently decline obeying any general orders issued by authorities at a distance, for which reason all travellers who would not risk the loss of time and labour should make it a point, in such a case as ours, to apply to the government of each particular province for whatever they may require.

I have already attempted to demonstrate, in a separate philosophical memoir, that there probably existed, at one time, a communication between the Black Sea and the Caspian, but that it was interrupted at some unknown epoch, so as to leave behind a low and level tract, now intersected by the Manech, a slender thread of water, stretching nearly from sea to sea, being all that remains of the ancient channel; just as we often observe a body of water, after long-continued showers, subside into two adjacent depressions, but still leaving similar lines of communication, where we may sometimes even perceive traces of a current. More than once

as we roamed over this interminable plain upon our Kalmuk horses, with the broad vault of heaven above our heads, have I figured to myself this sea, as its waves once flowed, high over our path. But I was still more powerfully impressed with the wasting away of ages, when, at the conclusion of one of our excursions, we turned our horses through the Manech, which here divides into two branches not more than two feet deep, flowing through a number of little lakes and pools, and over the soft and loamy soil: an eloquent testimony of the early world, and well fitted to awaken, in the mind of the passing traveller, many a serious reflection on the changes of the earth and all that exists upon it.

The vexation which I suffered from being obliged to give up the prosecution of our researches as far as the Caspian Sea passed away the moment our resolution was taken and our faces again directed to the south, where lay our final goal. Our last night upon the Manech was gloomily spent in the open air, under incessant rain, and far from any human dwelling; we were, therefore, not a little pleased and surprised to encounter, about midday, upon the farther side of the river, a moving town of one hundred and fifty Russian wagons, which were laden with brandy from Astrakhan, and were pursuing their way to Stavropol in one long, regular line. This arrangement, that had so much the appearance of battle array, was not made without good cause: the guides were obliged to hold themselves thus prepared for an attack, as it was not many hours before our meeting that this very caravan had ten pair of oxen cut off by an armed body of men at the passage of the Manech: a plain intimation for us that it would be mere foolhardiness to risk our lives and the success of our enterprise by incautious adventure.

Accordingly, on finding ourselves received with reluctance and distrust in a Trukhman oul, where we applied for admittance the following night, we thought it more advisable to encamp some miles farther on, at a distance from the usual track, in the open steppe. We stopped but at one other oul, a Tatar settlement, where we experienced a hospitable reception, and were cheerfully furthered on our journey, notwithstanding the astonishment shown at our appearance there. The first Russian village to which we came was Petrovsk: it lies on the Kalaus, at the foot of the hills; but it was at Donskaia Balka (*balka*, in Russian, means a narrow valley) that we first enjoyed the sight of trees, a smiling landscape, and the refreshing mountain breezes, which had been so long denied us. Here, too, we found ourselves in the neighbourhood of another considerable salt-lake, from which large supplies are drawn.

We started hence early in the morning, and soon arrived in sight of Elbrus, as this imposing magnate of the Caucasian Alps stood in full splendour, glittering nearly from summit to foot in the rays of the rising sun. From that moment the monotonous and insipid life and scenery of the steppe was forgotten, and all our aspirations were directed to the mountains, and were luckily destined to be completely gratified, thanks to the excellent arrangements of the postmasters, the smoothness of the roads, and the magical powers of our feldyäger; in fact, upon one occasion we passed over a distance of fifteen miles in three quarters of an hour.

CHAPTER II.

Preparations at Mosdok.—Vladikavkas.—King of Persia's Family.—Turbulence of the Natives.—Road to Kobi.—Height of the Mountains.—Hill Forts.—Tiflis.—Its Name.—The Georgians uncivilized.—Perpetual Wars.—Victories of Paskevich.—The Plague.—Position of Tiflis.—Experiments with the Pendulum.—Magnetic Needle.—Heights round Tiflis.—Garejan.—Elizabeth-thal.—Geology.—Coal near Tiflis.—The Hot Springs.—Their medical Virtues.—Chemical Analysis.—Temperature and Quantity.—Weather in Tiflis.—Heat.—Variations of the Barometer.

Upon our arrival in Mosdok we found our companions in good health, and ready to undertake the passage of Caucasus, which is now no longer attempted from Mosdok as before, but from Yekaterinograd, where it is indispensable to provide a small military escort; in which case a body of infantry, though consisting of only fifteen or twenty (as ours did), will occasion great loss of time, whatever security it may afford. Horses are always to be had between Yekaterinograd and Vladikavkas, at a reasonable rate, either from the Russian peasants, the friendly Cherkesses, or the officers of the garrison. The distance is seventy miles; and we paid but ten rubles (banco) for each horse. The route lies over a plain, which rises with an imperceptible acclivity, and is intersected by three impetuous rivers, the Uruk, Beleya, and Ardon; and half way between Yekaterinograd and Vladikavkas, by a ridge parallel to the main Caucasian chain, a worthy precursor of the sublime scenery which awaits the adventurer in the upper ranges of the mountains, but unhappily infested by the wretched freebooters, who equally find security and refuge in the thickets of the plain and the forests

of the hills, and are barely held in check by four strong military posts.

In Vladikavkas we had the honour of an interview with the Persian prince Khosref Mirza, one of 380 children and grandchildren of the male sex alone, descendants of the Kajar Fet Ali, the present Shah of Persia, who was the parent of eighty-six sons and fifty-three daughters as early as the year 1826, and regarding whose family instances can be adduced of its having been increased by twenty members in a single week. Vladikavkas is still, as formerly, highly important as a central military post, and forms a refuge for the reception of all those whose adventurous spirit may have exposed them to the treacherous attacks of the Cherkesses and Kabardins; for so great is the barbarity of the surrounding tribes, that the shortest excursion is attended with danger, unless under military protection, and is, therefore, strictly forbidden. A short time before our visit, ninety-five horses had been stolen from under the very walls of the fortress; and during the period of our short stay of a few days, we witnessed the unexpected spectacle of a large body of Ossets, who had placed themselves under the protection of Russia, driving off a flock of 600 sheep from the Chechenzes, by way of reprisal for the loss of 400 oxen; and this they did without waiting for support from the garrison, and led home their prize with every expression of exultation and delight, shouting, throwing their caps in the air, and discharging their firearms.

Our two travelling wagons were by this time so much out of repair, that it would have been unadvisable to take them with us over the mountains; they were accordingly left behind at Vladikavkas, where we engaged three Russian teleggas for our baggage; for the traveller himself always finds it

most convenient to proceed on Kossak horses, which can be supplied at every station for twelve kopeks the verst. The telegga is a primitive conveyance, in which durability must be held to compensate for the uneasiness of the seat it offers to the passenger, which is the only inconvenience he is likely to suffer. We had to pay forty-five rubles for every horse to Tiflis, which is a distance of 126 miles, besides agreeing to bear the expense of the additional horses we might want in crossing the Cross-Mountain, and which are to be obtained in Kobi, at the northern side of the mountain. Vladikavkas is forty-five miles from Kobi. Whoever once makes this journey will not easily forget the sublime impressions produced by the scenery on the road: the steep and towering heights near Dariel* and Lars, boldly crowned with villages and robber-holds; the chilling gloom of the rugged passes; the roar of the Terek, as it sweeps along its stony bed; the softer slopes of the valleys between the Kasbeg and Kobi, dotted with Georgian and Ossetian cottages; and the majestic head of the Kasbeg raised proudly above all.

From Kobi the top of the Cross-Mountain may be reached in two hours; from this there is a farther ascent to the Gud Mountain;† and in three hours more we arrive at Keshour, the first military station upon the south side of the mountain; the distance is computed at eleven miles. The extreme point of the Gud Mountain is 7977 English feet above the sea, and consequently about the height of the road over the Great St. Bernard: on the Cross-Mountain, properly so called, and where

* There is a splendid view of this district given in the "Voyage aux Indes Orientales pendant les années 1825–29, par Charles Bélanger, Naturaliste-Directeur du Jardin Royal de Pondichery."

† Probably so named from the Ossetian district and village Guda.

there is a stone cross erected to General Yermolov, the road ascends to the elevation of 7861 feet; but the cross stands thirty feet above it. No one who travels from Kobi to the Cross-Mountain during the summer should neglect to visit a mineral spring, about three miles beyond Kobi, which gushes from a small opening in the limestone rock, nearly on a level with the stream of the river Thetrizkali, just where its right bank sinks precipitously down. This water is sulphureous, with a large quantity of carbonic acid, and has a delicious taste: its temperature I found to be 41° 72′ Fahr. in summer, and 40° 28′ in winter.

The southern declivity of Caucasus, where the road penetrates into the valleys of the Aragvi, is warm, rich in a luxuriant growth of trees, well cultivated, thickly peopled, and adorned with many interesting ruins, partly the remains of churches, partly of proud-looking hill-forts, with their towers and outworks, all exciting an almost irresistible curiosity to investigate their origin, date, and the history of their founders. I myself have carefully examined several of them as far as it was possible in a hasty and passing survey, have sketched them, and sought anxiously to discover any evidence whatever which might explain their former history and condition; any inscription even, or characteristic embellishment or sculptures, but never have been able to make the slightest progress towards the solution of the mystery. Still I cannot help feeling persuaded in my own mind that many a relic of the classic ages might yet be found upon this spot. For this, however, a course of investigation would be necessary beyond what the passing traveller could make. It could only be determined by some one having much time at his disposal, an accurate knowledge of antiquities, perfect

acquaintance with the language, and sufficient intercourse with the natives.

It was on the night of the 5th (17th) of June that our small caravan entered the city of Tiflis, the capital of our Trans-Caucasian provinces. The name is taken from the Georgian word *tbili*, warm, imposed probably in consequence of the many warm mineral springs which are found in the town. Or this appellation may, perhaps, be referred to the contrast between the mildness of the climate of Tiflis and that of the former residence of the Georgian kings in Mzcheta, which is situate on the side of Caucasus, where the atmosphere is much more cool. The building of Tiflis, and the removal of the seat of government thither, took place about the year 455 of our era, under King Vaktang I., Gork-Aslan.*

To hear of Tiflis, or to have visited Tiflis, never fails in Europe to excite a degree of interest, which seems neither to be justified by distance, nor any other striking peculiarity which that city possesses; an interest, too, which is so much the more extraordinary, since every stranger in Tiflis is so sure to express himself in the language of discontent, that it becomes at last inconceivable why every other foreigner is not deterred from venturing to visit such a place.

There is no doubt that Tiflis, both from its geographical and local position, would be one of the most delightful spots upon the earth, were it not that the mountains among which it lies, and which might otherwise contribute the most to render it agreeable, are totally divested of wood, and consequently deprived of those natural treasures, fertilizing and cooling rivers and fountains; for, if we except the little stream, the Dabachaná, which

* Klaproth's Travels, i., 715; ii., 164, and Rottiers.

flows from one of the western valleys between the warm mineral springs till it joins the Kur, there is only one poor rivulet, which trickles down from the Narikaléh, or rock-mountain, on the south side of the city, and distributes its scanty store to the vineyards in the town, into which it is only permitted to be turned for an hour or so under the superintendence of the police. The mountains about Tiflis are accordingly of no other use than to concentrate the rays of the sun, which would otherwise be kept off by the cool winds from the north and east, and give rise to those fiery blasts in the valleys, which strike the inhabitants like the air from a furnace, and, in all likelihood, occasion those diseases of the biliary organs which are endemic in the sultry districts of Georgia and Armenia.

The personal beauty of the Georgians* would naturally attract the attention of Europeans, and secure a lively interest in their favour, if their intellectual condition were only in keeping with their outward bearing. The Georgian would win the esteem of all the world did he but unite with the symmetry of his person and the energy of his character a taste for useful occupation, and the laudable improvement of the faculties of his mind; while the women of Georgia would be admitted on all hands to have a just claim to the possession of the highest order of female loveliness, did they not prematurely impair the advantages which nature has so lavishly bestowed upon them by the immoderate use of cosmetics, of apparel prejudicial to their health, and by their reckless licentiousness, instead of directing their thoughts to the regula-

* The Arabic name of the Georgians is Gurji, whence, probably, the Russian Grusia. The Armenians call them by the native name Vik, in the plural Virats or Vrats; and, as tan signifies a house or country, the appellation Vratstan is given to the kingdom.

tion of their households, to economy, cleanliness, the education of their children, and the other duties proper to their sex.

It must be confessed that in this, as in all other cases, some praiseworthy exceptions will be found; but I only speak here of the general impressions which are made by Georgian society upon a stranger, and am therefore obliged to aver that there is a total want of industry, activity, and domestic feeling everywhere apparent; and though cleanliness and love of order have, in a few instances, gained a footing among the higher class, it is yet only as objects of imitation and luxury, not of necessity and habit.

The venerable existence of Tiflis in an Oriental form gives it another claim upon the sympathy of Europeans, when we reflect that it has found means to maintain its nationality, by an enormous expenditure of life, for 2000 years, against the Persians, Turks, and Caucasians; and it is only now, and by friendly intercourse with strangers, that that independence is threatened which hitherto has baffled the utmost efforts of Mohammedan and Pagan. Notwithstanding the presence and example of numerous strangers from Russia, Germany, and France, the Georgian still adheres to his own primitive agricultural implements, and defective system of cultivation in the field, the vineyard, and the garden. He is not even so far advanced in the construction of his mills as to supply himself with a good quality of flour: this has to be procured from the Russians. His antiquated wheel-carriages are still as clumsy and rude as they were in the Golden Age. He still, as of old, shaves off all the hair from his head, which he covers, when he goes into the broiling sun, with a heavy cap of sheepskin, well calculated, when aided by excesses in

the use of wine, to produce a constant determination of blood to the brain. The native of Tiflis still makes it a daily practice to indulge, as of old, in the use of his disgustingly filthy sulphureous warm bath, where he exposes his body for hours to the heating and enervating influence of the vapour.

Yet all this is national, and sanctioned by immemorial usage. What are we to think, though, of the merchant of Tiflis, with his stiff collar and Oriental robes? What of a coquetish Georgian lady, with a French capote instead of the veil of the olden time? Why must the houses of Tiflis, with their well-contrived flat roofs of clay, overgrown with weeds, to which the city is indebted for immunity from fires—though, even here, a violent storm of lightning, occurring during the height of the summer, will occasionally set the dry grass upon the housetops in a blaze—why, I ask, should this roof of the southern Asiatic, the place of his recreation and exercise, give place to the high, sloped tiling of the North? But the Georgian will one day have to deplore the total downfall of Georgian customs, under the influence of modern refinement; the main cause of all which changes must be sought in this truth, that no characteristics of a people, unless founded on pure religious feelings, can ever draw down a permanent blessing, or command respect; and this is the basis which the Georgian nationality has failed to establish.

The Georgians had an early knowledge of the Christian religion, even as far back as the fourth century, according to historical records,* but never made any advances towards that more spiritual acknowledgment of its truths which is shown by its

* According to the Chronicle of Vaktang V., in the monastery of Gelati, in Imeretia.

influence on the collective habits of a people; for ever since their conversion till the present time, the political life of the Georgians, foreign and domestic, has been one uninterrupted succession of devastating wars, in which the kingdom, for full fifteen hundred years, was distracted with intestine feuds, or left a prey to the inroads of the emperors of the East, the Arabs, Jingis-Khan, Tamerlane, the Turks, and Persians. Tired of such an existence, the Georgians threw themselves into the arms of the Russians, and obtained the respite from external aggression they had so long desired; and now may it be vouchsafed to the exalted statesmen who preside over these provinces to infuse the spirit of their own administration into the lowest ramifications of the civil power, so that the streams poured over the land from the pure fountains of an exalted beneficence shall be no more wasted on the ungenial soil of selfishness and hardness of heart. Then will the bearer of the Russian sceptre be richly indemnified for the enormous sacrifices made for Georgia, by the blessings of a prosperous nation, more certainly than in the sanguine projects of those who expect to see Georgia the land through which European civilization shall be extended over the East—Georgia, where reading and writing are yet unknown, and where every attempt to introduce new, or to improve existing branches of industry, has hitherto failed, chiefly through the precipitancy of those for whom every enterprise, though but just begun, must result in instantaneous and brilliant success—Georgia, that by means of the energies still in chaotic fermentation within her bosom, and the unusual advantages offered by the Russian government to her officers, draws so many adventurers from Russia and from abroad; who all, nevertheless, from

the councillor of state, or general, to the humblest clerk, or Kossak, are inevitably seized, often even after a few weeks, with longings for their native land, and the lost paradise of home.

The governor-general of the Trans-Caucasian provinces, Count John Paskevich, to whose protection, as I have already mentioned, our party was recommended, had, at the time of our arrival in Tiflis, taken the field against the Turks, where a sense of honour and duty detained him. Accustomed to the presence of an enemy many times outnumbering his own troops, he had, in full reliance upon the heroism of his men, judiciously disposed his army upon several points, so that, by a succession of actions which took place within four weeks, Akhalzike was relieved, the Pasha of Trapezunt beaten before Kintrish, the Kurds driven beyond the Araxes, and such decisive measures taken as soon afterward delivered the city of Erzerum, and consequently the key to all Natolia, into his hands.

The Count—there are many counts and princes here, but every one in the kingdom knows who "the Count" is—had committed our affairs to the military governor-general, Stephen Strekálov; that is, he had shown us every mark of kindness that circumstances allowed, inasmuch as General Strekálov seized every opportunity of evincing, both by word and deed, his respect for science, and his appreciation of every attempt to extend the bounds of knowledge. The will of Providence was, however, opposed to the wishes and expectations of us all. My first interview with the governor was only to receive the confirmation of the discouraging reports which we had already heard in Caucasus, that the plague had really broken out in Erivan and the neighbouring towns, and had extended its

ravages so far that it had carried off 3000 persons since the month of February. Such an untoward event might well subdue the spirits of the most ardent; besides, whatever expedient might be imagined with the view of obviating this impediment, it was rendered nugatory by a decided prohibition from the government. We were consequently obliged to submit with patience to what it was not in our power to redress; and unwilling as we were to renounce all hopes of ultimate success, we determined to await the result in Tiflis, where we should have many oppo tunities of employing ourselves usefully in the mean time.

And here, after the first feelings of discontent at the disappointment of our hopes had passed away, I could not resist the conviction that, in this unexpected delay, the finger of our watchful and omniscient heavenly Father might be traced in reference to ourselves. I reflected upon the repeated obstacles that arose to prevent our departure from Dorpat, and the vexation we had suffered from that delay, and then asked myself, as much in a spirit of gratitude to the Preserver of our existence as of humiliation at human presumption, what might have been our fate if we had started from home, as we had first intended, about the New-year, reached Tiflis in February, impatient to prosecute our journey to Ararat, and there, or on our road thither, without having taken any precautions, and without any means of protection against it, had fallen a prey to the plague before its approach had become generally known.

One of our principal achievements during our stay in Tiflis was the astronomical determination of its geographical position. For this, our acknowledgments are especially due to the assiduity and talent of M. Fedorov, who devoted ten weeks

of most incessant and anxious labour to it, and, as his instruments were of a very superior kind, the accuracy of the result may be relied on. The tower of the Cathedral church of Tiflis lies, according to his observations, in 41° 41′ north latitude; its longitude is, according to Birdin, 62° 34′ east from Ferro.

Another object of our attention in Tiflis was a complete series of observations on the vibrations of the pendulum. The apparatus provided for this purpose had luckily escaped any injury by the journey from Dorpat, while the exact time necessary for the experiments was obtained from observations of the stars made by M. Fedorov.

The magnetic apparatus had likewise arrived in safety, and was employed to ascertain the dip as well as the declination of the needle with exactness: the dip was found to be 55° 31′; the declination 3° 47′ west.

Another interesting result, likewise deduced from my observations of the hourly variations of the barometer and thermometer, as well as of the weather in general, during the limited period to which they were confined, was the very striking regularity by which these phenomena were characterized. For information upon all these points, I must refer the reader to the scientific papers in the second part of this volume.

We also made short excursions into the environs of the city, as far as the oppressive heat of the season would allow, and collected many facts bearing upon the topography of Tiflis. Of these may be mentioned the measurement of the heights of the mountains which surround it, and enclose the valley which is watered by the Kur, and open towards the north and south. These altitudes were taken by M. von Behaghel and myself by simulta-

neous barometrical observations, determined with reference to the level of the stone bridge over the Kur, near the fortress. According to a very accurate levelling, likewise executed by M. von Behaghel and myself, from Tiflis to the shores of the Black Sea, and which are given at length in the scientific Appendix, the bridge just mentioned stands 1165 feet above the level of the sea, while the surface of the Kur, at the mean height of the stream, is thirty-one feet lower.* The city is built upon both sides of the river; the larger portion is situate on the right bank, where we find the houses of the upper classes, the great bazars or markets, the principal squares and churches, the public offices, and residences of the military governor and commandant, at from 80 to 100 feet above the bridge, while on the left we have a large karavansarai, the barracks, a line of houses inhabited by colonists from the south of Germany, and the fortress. Towards the south the city leans upon a high ridge, which approaches from the southwest, and on which are the grand-looking ruins of an ancient castle: this is the Narikaléh, or rock-mountain. This eminence, at the western end of the walls, rises to 415 feet above the same bridge, being still, however, a little higher farther westward; and from this point a puny rill of water is conducted to the city in a little conduit, which is for the most part totally dried up, and never carries any water unless it rains. At such times a crop of rich herbage springs up suddenly from the renovated soil around it, giving it the appearance of a glittering silver braid with green edges stretched upon the dusky ground: after a few

* To reduce this to Russian measures, it is only necessary to recollect that the Russian sajene, which contains three arjin, is equal to seven English feet.

days, however, the source dries up, and the rivulet is seen no more.

From this ridge, in a southwesterly direction, and along a road that is constantly up or down hill, we pass through a couple of finely-situated villages, and arrive at Kajori, five miles from Tiflis. This is the cheerful and salubrious country seat, selected with equal taste and unobtrusiveness by the former military governor, Sipægin, and to which he used to retire from the exhausting turmoil and idle uproar of the city, to enjoy the repose so necessary to restore the unceasing and beneficent energy of one intent only upon the common weal. The house is 3050 feet above the bridge over the Kur, and in such a situation that, owing to its height, despite the absence of trees, it commands a constant purity and coolness of air, and an exhilarating view over the distant Kur, a remote salt-lake, the adjacent hills, and, last of all, over a neighbouring pile of ruins. These last are the remains of the formidable stronghold of the notorious bandit Kara Oglú, who, about a century before, spread terror through the land, and whose crimes and violence are still preserved in many a popular legend. This fastness is erected upon a rock, and surrounded by abrupt declivities from 100 to 200 fathoms deep—a site so bold, and withal so secure, that it was only with imminent risk of life or limb that I could attempt or affect an entrance at but a single point into the interior of the masses of ruins of which it consists. Here I had hoped that I should perhaps discover some inscription or sculptured record of its history. There was nothing, however, to be seen but a single carved stone, built into one of the inner walls, with a cross in the middle, and a crescent above and below, in a rude kind of bas-relief.

The highest of the mountains that surround the town is on the west, at the right side of the Kur, and is called Mta-Zminda, or the holy mountain. At its foot lies the large and splendid mansion of the commander-in-chief, ornamented at the entrance with two enormous pieces of Turkish ordnance, a flattering present from his majesty to the leader who had conquered in all his battles with the Persians and Turks, and whom no fortress could resist. Upon the steep slope of this mountain hangs the little monastery of Garejan, under the patronage of David. It is one of the greatest ornaments of the town—its white walls relieved from the high and dusky background of rock by day, and its scattered lamps mingling themselves with the stars by night. This was the place chosen for his last resting-place by M. Griboyedov, the Russian envoy, who was assassinated in Teheran, and to this spot, accordingly, his earthly remains were conveyed in grand procession, and solemnly consigned to the tomb by the Eparch Jonas. The extreme point of this ridge rises to a height of 1112 feet above the Kur, and is visible from the city. This is only one end of a long mountain range, which, running from this quarter in a westerly direction, rapidly attains a much more considerable altitude, and somewhat farther off, owing to the increasing coolness of its climate, is partially covered with trees.

About four miles from the city there may be seen, upon a sharp, projecting pinnacle of the mountain, a stone edifice 3324 feet above the Kur, which may have been one of the many Christian chapels formerly scattered over this kingdom. The road from Tiflis, which takes the course of the valley under the crest of the hills, leads the curious wanderer by this spot, and then by a delightful path into the

Elizabeth-Thal, the prettiest of all the Wirtemberg settlements in Georgia.

There is, besides all these, a detached eminence, 764 feet above the bridge of the Kur, upon the left bank of the river, where the ground is high and level. This hill is east of the city, and has the shape of a flatted cone, with some old buildings on the top.

The geological formation of all these mountains is alternate strata of limestone and clay-slate, which lie almost invariably east and west, at an inclination of about 45° to the south. They were examined with the greatest care by M. von Behaghel, and will be found described in the second part of this work. A discovery which is calculated to excite very general interest is the existence of coal in beds, which, though having only a thickness of half a foot where they are exposed, may possibly be found of larger dimensions lower down. They crop out on the precipitous southern declivity of the Mta-Zminda, between the very loose strata of the bituminous clay-slate, and extend along it the distance of a quarter of a mile. These coals are of various qualities; their specific gravity, on an average, is 1·4; they burn readily at the blowpipe, and leave behind as much ashes as amounts to three fifths of the whole. Some traces of coal-beds are also to be met with a couple of miles above Tiflis, on the left of the Kur, where its banks are low and rocky. From this place two wagon-loads of coal had been procured some years ago for the use of the silk manufactory of M. Castellaz, and found very well adapted for the furnace. The merit of having made the first discovery of coal at Tiflis, which will be of the utmost importance if manufactures should ever be established, in a country so destitute of wood-fuel, must be assigned to M. Ra-

vergié, a Frenchman, who has now been some years a resident in Tiflis, and has made some very valuable observations in the department of natural history.

The warm mineral springs are, without doubt, the most interesting objects of philosophical curiosity about Tiflis. They burst out in great number from between the strata of limestone at the foot of the Narikaléh, which lies near the southern end of the city, and are then collected by means of a brass pipe and conducted into stone basins, or into large cubical bathing-troughs kept in the vaults of the bathing-houses, which are sometimes of considerable extent. As to the medicinal properties and chemical composition of these baths, we are not yet in possession of any very accurate information. They enjoy, however, a great reputation for their salutary effects in rheumatism, tetters, and contractions; but probably their beneficial operation upon the constitution of the Georgians is rather to be ascribed to the cleansing of the skin, of which these are so much in need. This point, however, it is almost out of the power of the physician to put fairly to the test, owing to the highly injudicious arrangements of their baths, as no attempts whatever are made to ensure their cleanliness, or to avoid the risk of catching cold after their use. Colonel Rottiers has given us, at p. 95 of his Journal, an analysis of the chemical ingredients in those waters, which stands thus: In 100 pounds of water there are

36	grains of	sulphate of soda,
24	"	muriate of soda,
19	"	subcarbonate of soda,
20	"	" lime,
8	"	" magnesia,
2	"	" iron,

9 grains of silex,
4 " resinous extract.

But he quotes no authority for this result, nor does he explain how it was obtained. As he seems to have omitted all reference to the volatile ingredients, for instance, the sulphuretted hydrogen, which is so easily detected, both by the taste and the peculiar smell which it emits, we may, perhaps, assume that the process employed was the evaporation of a large quantity of water (that of well No. III., 2d, perhaps), in which case the aggregate of the weights assigned to the foreign matter will coincide with the results of my own careful examination of the specific gravity of this water. By the analysis already cited, 122 grains of fixed foreign ingredients are contained in 100 pounds of water, and by my experiments, the water of the source No. III., 2d, was heavier than distilled water, at the rate of 128 grains in 100 pounds.

As regards the temperature of these springs, and the quantity of water they supply, though it is never allowed to flow in a continuous stream, but only when the pipes are opened for the daily use of the baths, I found, upon the 12th of June, at midday, that,

I. In the bath at the farther side of the little bridge over the Dabakhaná, immediately upon the right,

1st. The spring to the right, 109°·6 Fahr., gave, in $\frac{1}{4}$th of a minute, 250 cubic inches.

2d. That in the centre (left), 112°·3, gave, in $\frac{1}{4}$th of a minute, 400 cubic inches.

(These two are said to have the same source.)

3d. The spring to the left, 111°·4, gave, in $\frac{1}{4}$th of a minute, 90 cubic inches.

4th. In the vestibule, 111°·87, gave, in ¼th of a minute, 400 cubic inches.

(These two, again, are thought to have a common origin.)

II. In the next bath, high up on the hill,

1st. 114°·12, in ¼th of a minute, 360 cubic inches.
2d. 114°·12, in ¼th of a minute, 350 cubic inches.

(From one source.)

3d. 85°·1, in ¼th of a minute, 108 cubic inches.
4th. 101°·7, in ¼th of a minute, 190 cubic inches.
5th. 111°·6, in ¼th of a minute, 200 cubic inches.

(In the vestibule.)

6th. 100°·6. (The upright pipe in the vestibule.)

III. In the next bath, still higher up, called the brown bath,

1st. (On the right, going in), 74°·7, in ¼th of a minute, 180 cubic inches.
2d. (In the middle), 113°, in ¼th of a minute, 414 cubic inches.
3d. (At the left), 115°·4, in ¼th of a minute, 126 cubic inches.

IV. In the bath beyond the bridge, immediately on the left,

1st. 109°·17, in ¼th of a minute, 243 cubic inches.
2d. 108°·7, in ¼th of a minute, 225 cubic inches.
3d. 104°·4, in ¼th of a minute, 650 cubic inches.
4th. (The straight pipe in the vestibule), 106°·4, in ¼th of a minute, 144 cubic inches.

During this investigation, the temperature of the air outside the baths was from 65°·75 to 68°.

The heat of the springs was tried on several days, at different hours of the day, and for the most part found constant, or, at least, with no considerable or periodic variations. But, on the other hand,

the discharge of water underwent most extraordinary variations, so that I obtained every time different results; for instance, on the 14th of June, at sunrise, I found,

III. 1st. 74°·7, and 33 cubic inches;
2d. 113°·4, and 513 cubic inches;
3d. 115°·4, and 126 cubic inches;

the thermometer being at from 54°·5 to 56°·75 in the open air:* the specific gravity of the water drawn from

III. 1st, was 1,00044;
III. 2d and 3d, was 1,00022;

at a temperature (for the water) of 70°·9, and with an exceedingly accurate balance; it was always the same on different days. I also discovered that these mineral waters have the agreeable property of remaining perfectly clear after standing for several days in vessels either open or closed; that they form neither scum nor sediment; that they always retain a clean, pleasant, and somewhat sulphureous flavour, and lose nothing of their specific gravity. Boiling will discharge very little air from them, not more than two or three cubic inches from 100 of water.

As to the weather in Tiflis, from all I observed myself during my short residence there of two months, and from all I have heard from the inhabitants, I feel convinced that some most interesting results would be obtained if any one were to engage in such an inquiry for a few years, or even for a single year, without intermission. The exceeding regularity of its course is a striking characteristic, which could not escape notice even du-

* When the author speaks in this place of 10° or 11° of Réaumur, he ought to be merely understood as using round numbers —Ed.

ring a very short residence in this country, and hence may be drawn with tolerable certainty some general conclusions.

The heat and aridity of the atmosphere begin to be oppressive as early as the month of May, and they continue to increase through June, July, and August, till they become intolerable; so that, for three hours before, and six after midday, during these last two months, no one will willingly leave the house, in which, by dint of excluding the light of the sun, and sprinkling the apartments with water, some degree of coolness may be maintained. If Tiflis had the advantage of trees, the plan adopted in Bengal for cooling the dwellings might be introduced there. This plan consists in filling the open windows with green boughs, the evaporation from which will, as we are assured, reduce the temperature some ten or fourteen degrees. The Persian fans are, however, a very effective substitute for this: they are formed of some very light material, about a foot square, and so contrived as to be readily turned with the hand like a vane; this produces such a motion in the air that, when it is kept up for an hour or thereabouts, the increased evaporation from the skin will produce a very sensible, and, in irritable subjects, even a painful impression of cold.

There is one circumstance which, in my opinion, also contributes not a little to maintain a degree of coolness in the apartments of an Eastern house; that is, the peculiar roof, if we may be allowed to give this name to the uppermost floor or terrace of their houses. This is formed of a layer of earth and stiff clay, about two feet thick, quite even, but inclined by about two inches to one side, so that during a heavy shower of rain the water may not run off at all sides, but be directed through a couple

of openings in the parapet, which rises about a foot above the level of the roof. This bed of earth acts hygrometrically upon the atmosphere, imbibing the damps by night, which are again evaporated in the heat of the day, and, by a known law of physics, has a perceptible effect in cooling the air; whereas, under the usual European roof, which has been most unadvisedly introduced by foreigners into Tiflis, an actual reverberation of the heat takes place. These flat terraces are, moreover, usually overgrown with weeds; it is said to be particularly the Lepidium vesicarium which is there met with.* This becomes scorched in summer, and then is set on fire to get rid of the dry stalks, so that the fire, which soon seizes on this inflammable vegetable matter, will often present the startling and beautiful spectacle of a wide body of flame sweeping over the city in the night.

This terrace is also the place to which the Georgians of the ancient stock resort, when the sun has set and the heat of the day has declined, to enjoy themselves with their family and friends in the cool air, taking a look into the streets of the town, admiring the magnificent snowy peaks of Caucasus, or indulging themselves with tea or wine, and often passing the entire night on it in song and music; this is the place where many a one, exhausted by the heat of the day, and anxious to escape from the scarcely less intolerable heat of the night in the apartments below, tries to court the respite of a little refreshing repose under a tent; the place, too, where, upon all occasions of solemn processions through the narrow streets, the Georgian fair, enveloped from head to foot in their thick and snowy veils, find a convenient stand, from which they may see and be seen.

* Rottiers, Itinéraire, p. 133.

The extreme height of the thermometer during the period of my stay in Tiflis was 100°·4; this occurred on the 28th of July (9th of August, new style), between three and five in the afternoon, in a situation where, though the place generally was exposed to the sun, yet the instrument was shaded by a pillar. It is not, however, the mere intensity of the heat, which lasts but a short time, that renders the summers in Tiflis so oppressive, but rather the trifling diminution it undergoes in the night, so that it hardly allows the inhabitants a single hour to recover their energy. In the latter half of June, even, we usually had from 83° to 86° of Fahrenheit at 10 o'clock in the evening, and at midnight 77° or 80°; but in the month of July, at the same hour of the night, I found the glass at 86° and 88° more than once; and these observations were made, too, as might be said, out of doors, just against the open door leading from my chamber, which was large, and occupied only by myself, upon the gallery of our apartments in the upper story of the house, a situation which the direct rays of the sun could never reach, and where there was a free communication with the open air.

The hourly range of the temperature was also very remarkable. This will be apparent from the series of observations made every hour for seven days, which I have given to the public, and which must not be regarded in the light of a selection from a number of observations, but as containing everything noted in my daily register, and fully corroborated by the numerous observations on temperature which I made at different hours on other days, and incorporated with my journal. It appears manifestly from this that there was a uniform increase in the temperature from six in the morning till it reached its utmost point, not, as in

other places, about two in the afternoon, but between five and six in the evening, and that from this hour a steady fall took place through the entire night till six in the morning, when it began to rise again: so that the entire twenty-four hours were distinguished into two periods by the alternations of the thermometer—for the daytime, from six in the morning till six in the evening, during which interval it rose, and for the night-time, from six in the evening till six in the morning, during which interval it fell. The differences between the lowest degree of heat in the morning and the highest in the evening observed a gradual and pretty regular rate of increase with the season, from 5°·6 to 7°·8.* These rules, however, are only applicable to the months of June and July. As early as the end of August I perceived that the same hours would no longer give the tropical points of the temperature, but that the rise did not begin then before seven in the morning, while the decline had already begun by five in the evening. Every season would thus, perhaps, be found to have its own routine of change, the investigation of which would be a subject of deep interest. This, however, should be gone about with due circumspection, and instruments of approved construction; mine were to be fully relied on, and could occasion no error of more than 0·45 of a degree.

With respect to the annual range of temperature and changes of seasons, we may look upon the month of August as a tolerably well-defined tropic or epoch of change. The heat, which up to the end of July has been steadily on the increase, becomes stationary, at least, in August, and at last

* Let it be observed that the author's expressions 2°·5 and 3°·5 of Réaumur have more of the character of round numbers than their equivalents in terms of Fahrenheit's scale.—Ed.

begins to decline, so that August is to the rest of the year with regard to heat what five or six o'clock in the evening is to June and July; and it would be exceedingly interesting to discover the other half-yearly tropic also by direct observation. The information that I was able to obtain as to the general characters of the seasons leads me to conclude that the reduction of temperature goes on till the end of January or beginning of February, and that in this respect, too, the year, like the day, might be distinguished into two sections of opposite constitution. This would seem to be indicated at least by the reviving vegetation, the bursting forth of the verdure on the hillsides, the flowering of many shrubs, and the budding of the trees, just as the opposite change in August is attended with storms.

The same friends who cautioned me so seriously against attempting the journey to Ararat during the heats of August, cheered me at the same time with the confident prediction that we should, as usual, experience violent storms and showers towards the close of the month, by which the intensity of the heat would be subdued. And just so it occurred. After we had only once had a refreshing fall of rain in Tiflis (in the night of the 22d and 23d of July), and had, except for this, suffered from most oppressive drought, we observed, on our return from Kakheti on the 24th of August (5th of September), that a heavy thunder-cloud had settled over Tiflis; the lightning began to flash, the thunder to roar, and violent rains succeeded, till, after a four-days' continuance of these atmospheric discharges, the serenity of the weather was restored, and a refreshing temperature communicated to the air. In December and January, that season of the year sets in which may be termed

winter, if a few slight night-frosts, a little snow, that disappears in a few hours, and a daily range of 43°·25 of heat, give a title to that name.

I must not attempt to draw any conclusions as to the mean temperature of the whole year in Tiflis, in consequence of the short period to which my observations were limited. Should any one, however, wish to make use of the mean of the extremes which I had an opportunity of registering, I find, from the notes of my observations in round numbers, that the highest ordinary temperature in July and August was—

	Reaum.
The highest (July and August) - -	24°·0
The lowest - - - - - - - - - - -	21°·0
The highest (December) - - - -	6°·0
The lowest - - - - - - - - - - -	0°·0
Mean - - - - - - - - - - - -	12°·7*

For the reasons already given, I can attach no great weight to this result. The coincidence which it shows, however, with the temperature of one of the few wells (the only one, perhaps) in Tiflis, is very striking. This well is situate in the neighbourhood of the Russian Cathedral, is very small, constantly covered with boards, and twenty-three to twenty-four feet deep to the surface of the water. The water that I had repeatedly drawn, with great care, in a large pail, had a constant temperature of 12°·1 (R.).†

My observations on the extremes of the heat, too, evinced the same character of uniformity in a very striking manner. But in this, my own experience is at variance with the statements of many

* These data, reduced to Fahrenheit's scale, cease to retain uniformly the visible character of round numbers. They will then be respectively 86°, 79°·15, 45°·5, and 32°; mean, 60°·5.

† 59°·2 Fahr.

other authorities, who represent the alternations of the temperature in Tiflis as very great in the hottest part of the season, and assert that this is the cause of many dangerous disorders. In 300 observations that I made from the 8th of June to the 31st of July, and some of them at midnight, I found that the lowest degree of heat was 67°·3 Fahr., the highest, 91°·4; and that the extreme change within the twenty-four hours was ordinarily 7°·8, never more than 10°·8.

Whatever may be the evidence afforded of a high degree of regularity in the atmospheric changes by these observations on the temperature of Tiflis, those derived from the barometer certainly have that tendency. At first, when I was engaged in other investigations, and my notes were, consequently, taken but three or four times a day, I made no farther remark than that the barometer showed a steady tendency downward from about six o'clock in the morning to midday; but afterward, when I found time to institute hourly observations, I could not but perceive that this was an incontestable and constant law, that the atmospheric pressure in June and July diminishes uninterruptedly and invariably from six in the morning till six in the evening, and then, again, increases with equal regularity from six in the evening till six in the morning; and this, on the average, by about 1·4 line. This law, too, is not deduced merely from a subsequent comparison of a series of observations, but from numerous entries that were made in the daily register, at the several hours, as they were ascertained. Combining them altogether, the result is, that in 368 hours (of the day) of barometric depression, the aggregate fall was 44·4 lines, out of which there were only 22 on which the rise was, altogether, 1·5 line; conse-

quently, in exception to the rule: and again, that in 413 hours (of the night) of barometric ascent, the aggregate rise was 26·8 lines, and out of these there were only 63 when it had fallen or moved in opposition to the rule; so that the exceptions amounted to $\frac{1}{30}$th in the former instance, in the latter to no more than $\frac{1}{13}$th, which must be looked upon as an exceedingly small proportion in such investigations. So sure was I of this fact, that I often amused myself and my friends by pronouncing, from an inspection of the barometer, whether six o'clock was past.

It is, at the same time, undeniable, that the season of the year, and probably, also, the situation of the place, has a positive influence upon these oscillations of the barometer. This was a remark I made myself in Kakheti, where I was in the month of August. Here, among the mountains, the regularity was not nearly so observable as in Tiflis; the number of exceptions was greater, and the tropical points, when it was possible to note them, were not at six and six, but at seven in the morning and five in the evening.

The height of my place of observation was, according to the series of levels which I had myself taken, 1258 feet above the sea; so that, if we assume, according to general laws, the height of the barometer at the sea, the mean height for Tiflis may be easily deduced. Assuming 388·5 lines for the height of the mercurial column at the seashore, at a temperature of 63°·5 Fahr., and the general heat of the atmosphere to be 77°, then the barometer in Tiflis will stand at 324 lines. But the 332 observations actually made in June, July, and August give only an average of 320·5 lines; consequently, 3·5 lines less than the calculation. The cause of this, however, is quite obvious; my ob-

servations were exclusively confined to the hottest part of the season, when, as it is well known, the barometer stands lower than in winter; hence the apparent discrepancy. Whether it really would rise to the height here indicated, I should not venture positively to maintain, as this altogether depends on the state of the barometer, which we have only theoretically assumed, for the level of the sea. The foregoing is taken from the hypsometric tables of Lindenau, the accuracy of which, however, seems liable to some doubt, particularly as regards the construction of the barometers employed. The decided influence which the season of the year has on the mean height of the barometer is palpable, from my own observations even; for in 294 which I had registered between the 7th of June and 31st of July, the mean was no more than 320·4 lines, while, on the other hand, the 38 heights observed between the 24th of August and 1st of September, after the heat had received a check from the storm, showed a mean of 321·5.

On referring to the oscillations of the barometer, it will be seen that the narrow limits within which they are confined furnish indications scarcely less positive than those derived from temperature of a climate approaching the equator. The extremes of the barometer noted during my residence in Tiflis appear only six lines apart, and this only in a single instance; the extremes differed but three lines from the mean.

As to the question of the absolute range of the barometer, I have merely to observe, that the instrument I used was a cistern-barometer, in which the influence of capillary depression amounted to half a line.

CHAPTER III.

The Plague impedes the Enterprise.—Excursion into Kakheti.—Wine of that Province.—Skin Bottles.—Intemperance.—Wine Jars in the Ground.—Their great Size.—Mode of making them.—Drinking Vessels.—Ploughs.—Crops.—Mode of Threshing.—Corn Magazines.—Rate of Production.—Want of Mills.—Flour imported.—Disturbed State of the Country.—Yenisseli.—Prince Dsiorgadse.—The Lesghi.—Constant Alarms.—Consequent Loss.—Excursion in the Hills.—Mount Kadori.—Its Summit.—Effect of Elevation on the Circulation of the Blood.

During all these investigations my attention was constantly directed, as may be supposed, to the progress of the plague that was raging in the neighbourhood of Erivan. From the medical reports, to which his excellency the governor was so good as to allow me access, the conclusion at which I arrived was, that this disease is more like the bilious nervous fever in its character than any other; that it is disseminated, not by the operation of atmospherical miasma, but by contagion; that is, that it is communicated through a deleterious matter, engendered by some morbid action in the body of the sufferers, and then conveyed to others by exhalation, immediate contact, or infected clothes. Under such circumstances, we might reasonably hope to escape by using proper precautions during our passage through the districts wherein it prevailed; and as it was now evident from official returns that the disease was very much on the decline, both in point of severity and extension, we might have indulged ourselves with the cheering prospect of the resumption of our enterprise, but we were doomed to have our patience put a second time to the test by representations made to us

upon the danger we should incur in attempting to continue our journey at the hot season of the year, namely, in the month of August.

I was earnestly cautioned by persons, upon whose disinterested anxiety—not only for my ultimate success, but personal safety—I could rely, not to venture to set out at the end of July, when the broiling heat of the sun, scarcely mitigated by night so that one can exist with comfort, renders those who expose themselves to its influence in the open air liable to attacks of inflammatory bilious fever, which either carries them off at once, particularly if they are foreigners, or leaves them in a state of painful debility for a great length of time. However little I felt disposed to apply this advice to my own case, as I had been accustomed to a variety of climates, still, consideration for my companions, whose youth rendered their situation one of greater peril than mine, made it my duty to give way to the remonstrances of our considerate friends, and to await with submission the time that Providence should appoint for the attainment of our object. I was nevertheless determined in my own mind, if this period should be too far delayed to allow us to accomplish our journey to Ararat according to our original plan, that I would dispense with the scientific apparatus, dismiss my companions, and start alone for the goal towards which I found myself impelled so irresistibly, that a near view of the Holy Mountain for only a few hours—the conviction that I had actually seen it with my own eyes—would have been a sufficient reward for all my trial.

It was the wish of M. Fedorov to prosecute his astronomical observations a few weeks longer, particularly with the view of being enabled to effect a more exact determination of the longitude of Tiflis.

He had, however, more advantages attending his pursuits than we in ours, as he might avail himself, for the most part, of the nights, and so avoid the oppressive sultriness of the day. The rest of us resolved upon undertaking a tour in the province of Kakheti, an interesting and agreeable strip of country stretching onward from the Aragvi, in a southeastwardly direction, between the Kur and the high ridge of Caucasus, for about 100 miles. It is traversed longitudinally by two rivers, a smaller named the Yori, and a larger, the Alasani, which unite and fall into the Kur. Telavi and Signag are two considerable towns in it; besides which, it contains eighty-three villages, surrounded by orchards, cornfields, and vineyards of immense extent, being at once proofs of the fertility of the soil and the genial character of the climate. Its chief productions consist of wine, corn—principally wheat—about half the quantity of barley, some millet, together with a large proportion of silk and honey.

There is an active export of wine; for the Kakheti wine is duly—unfortunately, sometimes unduly—prized throughout all Georgia as the very best, though it cannot admit of any doubt that the art of making wine is still but very imperfectly understood in this province, the esteemed produce of which is totally destitute of the true aromatic flavour of wine, and will not keep more than five or six years. Stories of ten-year-old wine are looked upon as suspicious by the initiated. However this may be, there is certainly enough of it drunk beyond Caucasus to afford a knowledge of its properties. Their mode of keeping it, not only here, but in every other district of Georgia, seemed to me to be both instructive and interesting. They have no casks, but keep it in earthen jars and leathern bottles. These latter

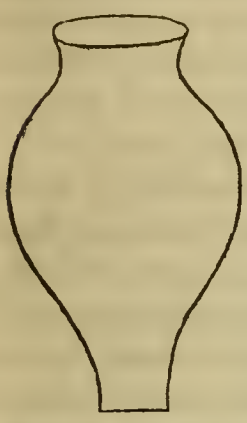
are made of the skins of goats, oxen, and buffaloes, turned inside out, clipped with the scissors, washed, and rubbed over with warm mineral tar, or, as it is also called, naphtha. The openings are closed with a sort of wooden bung, except at the feet, where they are only tied up with a cord. The wine is drawn at one foot merely by opening or closing the noose. It is a very strange and whimsical sight for the new-comer to see oxen and buffaloes full of wine lying in the wine-booth, or about the streets, with their legs stretched out. These skins, however, are very convenient for home use or for carriage; for they may be found of all sizes, some very small—the skins of young kids—holding only a few bottles; at the same time, these latter come very rarely into requisition.

The Georgian who has a mind to enjoy himself, with his family and two or three friends, in a little country party, is not likely to content himself with so slender a provision. The usual wine measure in retail trade is what is called the *tunge*, which contains just five of our ordinary bottles; half a tunge, however, is sometimes sold; but it is by no means thought, in Georgia, a proof of extraordinary intemperance for a man to drink two tunges of wine in the course of the day. It might be supposed that the naphtha on the hairy side of the skin would impart a strange and disagreeable flavour to the wine, and spoil the vessels. This flavour, however, is partly lost after the skin has been some time in use, which then becomes more valuable than when new; and besides, there are many connoisseurs of Kakheti wine, who maintain that it is this very flavour which renders it not only innoxious, but wholesome.

The other mode of keeping wine in large jars is generally adopted in the country parts, and more especially for the better kinds. Let the reader

figure to himself an egg-shaped vessel, narrow below, with an opening above, of a foot and a half in diameter, and thin sides, smoothly and regularly made of clay, and he will have a tolerable idea of what, when it is of larger size, is termed, in Georgia, a *kvævri*, and when of smaller, a *kh'ila ;* they are both of this shape.

Such a jar as this is firmly sunk in the ground to the brim, and when filled with wine, its mouth



is covered with a round piece of slate, and heaped over with earth, which serves the twofold purpose of preserving the wine, and concealing the place where it is buried. This covering must be removed and replaced every time wine is drawn ; so that, to avoid this trouble, when the jar is about half empty, the remainder of the wine is poured into a smaller one. These vessels are very lasting, suffer no leakage, although they are not glazed, and do not become soaked, but may be kept in use for twenty or thirty years, as I was assured, if not broken through carelessness. They are made of very large size generally, six or seven feet high, and four feet wide, with sides of half an inch thick or less. Such a one sells for ten to fifteen silver rubles, and, in good wine years, for more. One of the largest that I have ever seen, perhaps the largest kvævri in all Kakheti, was at Yenisseli, in the prince's house, where I measured it ; it was $6\frac{1}{3}$ feet wide and $8\frac{1}{2}$ high—so high that a servant was obliged to use a ladder to get into it—and held five arabá, each arabá being 88 chapp, and each chapp $4\frac{1}{2}$ tunges, so that its entire contents were about 7000 stoof of Riga.*

* Equal to 2036 imperial gallons, or nearly 34 pipes.—Ed.

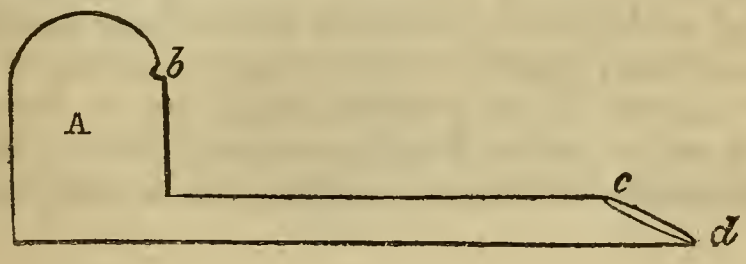
The process of forming these vessels out of clay so thin that it is incomprehensible how they are prevented from falling to pieces in the hand, and withal so shapely and so serviceable, would certainly be a very interesting sight for any one who had an opportunity of visiting their potteries, and displays a skill which might astonish many a practised artist in Europe. The principal requisite is well-prepared clay, which must be perfectly cleared from gritty particles, spread out upon a smooth surface, and slashed with a sort of wooden sword till reduced to an extraordinary degree of purity and uniform consistence. The potter first forms the lower end upon a solid low stool, simply with the hand, without any wheel, and proceeds in this manner as long as the temper of the clay will allow the jar to hang together; he then spreads soft moist leaves over the edge, leaving his work for a while to a gentle evaporation of its superfluous moisture, and passes to another article, of which there are mostly six, eight, or ten in hand at once. When the first jar has acquired a little firmness, he removes the leaves, makes depressions with his fingers all round the edge, and forms a new border on it, about four fingers high, with a long roll of clay that he holds upon his arm, taking the precaution, now, to proceed in a direction opposite to the one he took in making the indentations before, so that the fresh clay may be more firmly imbedded into the depressions; he goes two or three times round in this manner till the new border is about a span high, when its softness might expose it to the danger of giving way.

Besides the hands, there is nothing used but a small board for rubbing and smoothing the internal and external surface. The nipping of the edge is only necessary after the several pauses in the ma-

king, not when there are a number of bands of fresh clay added at once. If the jar should become too high, the workman uses a bench to stand on, and as the lower end of the vessel is very narrow, he props it as soon as it is dry enough with pieces of wood and stones; for, except the shed in which the work is carried on, no farther apparatus or arrangements are thought of. The baking of the jars, after they are dried, is conducted in the usual way; they are laid in pairs in a large kiln of masonry constructed in the earth, where they are managed with great adroitness.

While the native is found to prefer the skins and earthen vessels, such as his forefathers used for centuries, the German colonist in Georgia manufactures handsome casks, of good materials and every size, after the German fashion, in which his wine keeps better and sweeter, at least as far as the skins are concerned.

When the rich drink in their own houses, they are served in goblets and glasses, which are filled from wine-jars of the ordinary form; but when from home, they suit themselves to their ancestral habits, and use drinking vessels of many, and in some instances quite peculiar shapes, made of clay, wood, or silver, of which the kh'ala struck me as the most extraordinary. This consists of a wide part or body (A), commonly turned out of a single piece of wood, and so large as to hold about two glasses, with a small hole at *b*; the other part is a pipe, likewise of wood or a reed, and is sloped off like a pen from *c* to *d*.

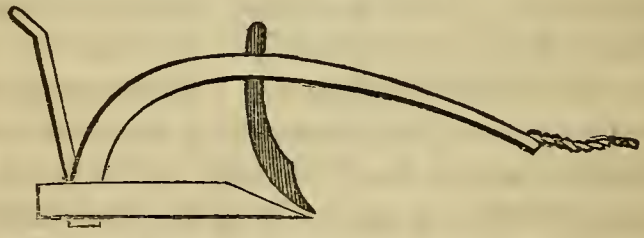


The wine is poured in through the pipe. In drinking, the point *d* is placed upon the lip, while the hole at *b* is stopped, so that the air can only enter at *c*, and makes the wine come gurgling into the mouth, in which the stanch drinkers take a particular delight. The same effect is produced, though by a very different contrivance, by using a vessel of glazed clay of the following shape:



At the mouth there is an expansion where it is applied to the lips, and the neck is twisted and furrowed; but the peculiar feature is a partition at *b*, with four holes in it, through which the air enters, and the wine issues with a gurgling sound, or, as it is there expressed, with music.

The agricultural implements of the natives of Kakheti are similar to those found in other parts of Georgia. The plough is usually of two sorts, a lighter and a heavier. The former

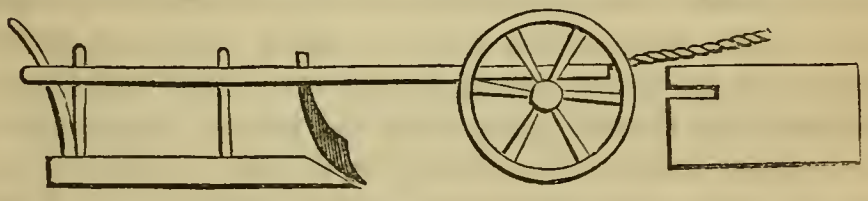


consists of a horizontal share, with an iron point, a single handle, and a beam of strong wood, much bowed, which carries an iron coulter, and to which the cattle are yoked. This is constructed upon the very pattern of the ploughs which are to be seen in the neighbourhood of Lyons, and farther down in the south of France; in fact, the identity is so

complete, that I might as well have taken the foregoing drawing from the journal of my visit to France in 1817 as from my note-book of 1829.

The larger Georgian plough has likewise a horizontal share, as well as a handle and coulter, similar to those described above; but the combination of the several parts is quite different, as the drawing shows; and it has, besides, an earth-board and wheels.

The earth-board is exceedingly simple, being merely a board without any curvature, almost two feet long, and having a narrow, deep notch in it for a handle, which is held by the ploughman in his right hand, while he holds the plough itself with his left. The axle of the wheels is full six feet long, and carries on one end a large wheel, which moves in the furrow last made, and on the other one much smaller, frequently not more than ten inches in diameter, cut out of a single piece, and running on the unploughed land. The iron end of the share



is straight on the left side, but bowed on the right. This plough makes a very uneven furrow, as the small wheel causes many deviations, owing to the irregularities of the ground it rolls on; it is, consequently, exceedingly difficult to guide. In a heavy soil it requires eight or even nine pairs of oxen or buffaloes, with several drivers.

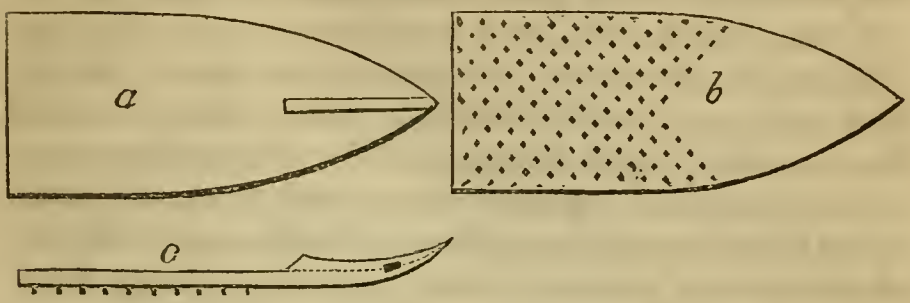
The usual Georgian harrow is an original contrivance: it is a broad, flat besom of strong brushwood, with the ends trimmed close. The thick end of the boughs is fastened in front to a board

eight feet long, standing on its thin edge, and from this there runs a sort of fork, to which a long, stout rope is attached, with cross-pieces or bars for yoking the oxen or buffaloes to, of which five pair are frequently employed. The rope is ordinarily made of twisted withes. A second board is fixed across the forepart of this bush-harrow, and upon this the husbandman takes his stand, while a number of drivers accompany the team. In this way the dry clods are thoroughly crushed and broken down, but the operation is very tedious.

The system adopted by the natives of Kakheti and Georgia, both in getting in and securing their corn, is also very peculiar. Of this, the greater portion is wheat, the amount of barley and millet being inconsiderable. Oats are never grown for the horses, which are fed altogether on barley; and even the German colonists in Georgia follow this practice, as they find the oats less productive, while the barley suits the horses quite as well. The wheat is cut with a large sickle, about a hand's breadth or a span below the ears, so that the long straw remains on the ground, where it is converted into manure by burning, the only aid which tillage gives to the arable land in this part of the world, for the district is too limited to admit of fallows; and besides, the cultivation of grasses, or any sort of green crops that might serve for fodder, is so little understood, that in this productive country and climate the horses often suffer from a scarcity of hay in winter.

After the wheat is cut, it is spread upon a levelled plot of ground, where the clay is stiff, twenty or thirty paces in diameter, and there, instead of being threshed, it is treated in the following manner: a board, about six feet long and twenty-eight inches broad at one end, but running into a point

at the other, and formed of a single piece of hard wood, is now had recourse to: the upper side is shown in figure *a*, the under in *b*. It is about two



inches thick, with the pointed end turned upward, as in figure *c*. The greatest part of the under surface is provided with lozenge-shaped holes, disposed in regular rows, into which sharp pieces of hard limestone, or half-glazed tiles, are inserted, so as to give this surface something of the character of a very coarse file. The upper side has a rib, running from the pointed end (*figs. a* and *c*), cut out of the same piece as the board itself, and in this a hole is bored, through which a strong leather thong or twisted willow rod is drawn; to this a pair of oxen or buffaloes is yoked. Such an implement is called *kh'ævri* in Georgian. The husbandman now mounts upon it, and drives the cattle with his board and himself in all directions over the corn. There are frequently as many as five of these threshing machines in motion together, yet they make way for each other with great address, though the teams are without reins, and managed merely with a long wand or by the voice. The peasant, when thus engaged, often takes his child with him to enjoy a jaunt, and his wife may at times be seen engaged in knitting on the same rude vehicle.

By this operation, which lasts about half a day, the corn is removed from the ear, and at the same time the short straw is crushed into small pieces

and rubbed quite soft. It would appear that the board must become very hot during this process, for, though the oxen are only driven at a walk, the kh'ævris that have been much used are quite brown on the under side, and sometimes even charred. When this threshing is finished, the corn is shovelled together towards that side from which the wind blows, the ground swept, and the winnowing shovel employed to separate the wheat from the chaff. This is an interesting sight for the stranger; the undressed corn violently flung from many large shovels into the air, and the grain pouring down a copious blessing from the sky, while the chaff is carried away like a cloud before the wind. One portion of the corn is now quite clean, and is taken away; but another portion still remains mixed with chaff, which has to be removed either by a second winnowing or the sieve.

The cleanest and best corn is laid up in woollen sacks in the house; the rest is conveyed to the corn magazines, which are of a sugar-loaf shape, sunk in the ground, and often lined with stones and plastered. The floor, about six feet in diameter, is spread over with a layer of coarse chaff, and the side-walls covered with large fresh ferns. It is now ready for the reception of the corn, which is discharged directly out of the wagons, between three pieces of felt cloth fixed to the edge of the opening, which answer the purpose of a funnel. This pit is about eight feet deep. When it is nearly full, fern is laid over the corn, and the mouth, which has a diameter of two or three feet, is covered with strong boards, and then earth laid over all till it is on a level with the adjacent ground. This is so carefully done that the place may be passed over without notice by a stranger, and even wagons may be driven across it, so that these mag-

azines, which are for the most part in the open courtyard, are well secured from thieves. At the same time it must be acknowledged, that this mode of storing corn, compared with the danger to which our magazines in Europe are exposed, is a strong evidence of the honesty of the people. Robbery certainly is a crime with which the Georgian cannot be reproached; it is, perhaps, less known to him and the Armenian than to the native of any country in Europe. During the period of our residence in the country, we never had occasion to complain of the dishonesty of the people: I never even heard of a single act of robbery committed by a Georgian or Armenian; and an accusation or indictment for robbery is almost unknown to the tribunals of Tiflis, though in matters of trade or commerce there is hardly a Georgian or Armenian who would regard it as an unpardonable sin to deprive another of his property by any trickery or fraud that can be practised.

In cleansing the corn with the sieve and the winnowing shovel, the hard, empty ears separate from the short, bruised straw; each is collected by itself, and the first, under the name of *jelgi*, is employed as straw; but the latter, which is termed *bsœ*, is used, and often without any addition of barley, as the ordinary, cheapest, and, at the same time, most approved fodder for horses and oxen, for which purpose its extraordinary softness gives it a decided advantage over hard, chopped straw.

Wheat, in spite of the defective system of husbandry, will here yield tenfold. The very imperfections in their method of converting their wheat into bread afford striking evidence of what the most ordinary degree of industry might effect in that country. I can ascribe it to nothing else than the want of mills of proper construction, with the

requisite bolting apparatus, that there is no fine white wheaten flour to be had in all Georgia, notwithstanding an abundant supply of the most beautiful wheat. The bread in common use is just of the colour and appearance of the inferior qualities of our rye bread, as black and uninviting, when made in the peasants' houses, as our coarsest black bread made of unsifted rye meal, and would never be recognised as wheaten bread if it were not already known to be so. Hence results what would otherwise be inconceivable when we consider the productiveness of the kingdom and its distance from Europe, namely, a large importation of flour from Russia. This consists chiefly of rye meal of an ordinary but wholesome kind for the use of the troops, which enters by the harbours of the Black Sea, but also of fine wheaten flour for the Russians and other foreigners of the higher classes in Tiflis, for whose accommodation a couple of French bakers and several of the German colonists have engaged in making bread of the finest quality; still gingerbread, biscuits, and other articles of confectionery, even zwieback, are imported for sale in considerable quantity from Sarepta, whence they are conveyed over the mountains to Tiflis.

Matters now began to look very discouraging for our excursions in the mountains. General Prince Alexander Chevchevadse, a nobleman distinguished for his services in the field, his refined European manners, and the love and respect with which he is regarded by all, especially by his countrymen the Kakhetians, had invited me to make this tour under the immediate protection of himself as military governor of the province. Still the connexions of the rude mountaineers with the Russians frequently undergo such changes in a few days, that hostilities will unexpectedly break out,

during which no one on the border is sure of his life at a few hundred paces beyond the villages. This was unluckily the case just at the time of our arrival in Kakheti. In consequence of some false reports, perhaps purposely spread abroad, of disadvantages suffered by the Russian troops in the Turkish campaign, the Lesghi, or properly the Leghi, as they call themselves, had made an irruption upon the frontier villages, so that we were recommended by the general to refrain from any attempt at continuing our excursions till something decided took place, which he gave us to hope would be such as to relieve us from all anxiety.

Receiving letters of introduction from our kind friend M. Ochkin, at Telavi, who was in command of the district, we determined, according to his advice, to change our residence to Yenisseli, a village on the farther side of the Alasani, just at the foot of the Caucasian Mountains. We were there received into the house of Prince Ivan Dsiorjadse, and his hospitable entreaties induced us to remain with him till the proper time should arrive for making a hasty visit to the hills. This interruption of our usual occupations would have made the time hang heavily upon our hands, had we not had ample sources of relief in the amiable personal character of the worthy old nobleman whose hospitality we shared. In him we found a man whose admiration and perception of all that is good and useful, mature understanding, and intimate acqaintance with the real position of his native land, united to manners at once easy, unassuming, and simple, but at the same time refined, were sufficient to ensure him the attachment and respect of every one of generous sentiments, and this, too, without his having had the advantages of a scholastic education, of filling any public office,

and consequently without rank or decorations of any kind. His entire delight at present is in the cultivation of his estates and the education of his two sons. It is to the information derived from this trustworthy and clearsighted representative of the genuine Kakhetian noble that I am indebted for all that I have been able to learn of this country beyond my own observations.

A report soon reached us that from 3000 to 4000 Lesghi had collected in the mountains, about four hours* from Yenisseli, and were ready to make an incursion into the Georgian territory. I am much inclined to suspect that their numbers were greatly exaggerated; but were they only 1000 strong, the near approach of such neighbours was enough to put us on our guard. The garrison of our friend's house, if we exclude the inhabitants of the village, could muster no more than ten, supported by our own party, with seven muskets ready for service. It was night. In order to put the surrounding villages on the alert, one of our Georgians, with a truly stentorian voice, was ordered to give notice of the danger. This he did at some length and in several directions, receiving an almost immediate reply from Gremi, Almati, Sabué, and Shildi, which places passed the signal on, in like manner, to the remoter villages. The shouts resounded fearfully among the valleys, and might possibly have reached the ears of the Lesghi themselves, who, notwithstanding their reputation for courage, will rarely venture to attack an enemy, let him be ever so weak, unless they can come upon him unprepared. At all events, they retired from this position, and sent their scouts in the direction of Quareli, who unexpectedly encountered

* An hour's journey is, for a footman, computed at nearly three, for a horseman at five miles.

a body of Russians, by which one of them lost his life, and the main body of the marauders were so alarmed that they returned to their homes. This, as was afterward ascertained, was partly owing to a want of provisions, as these brigands never prepare themselves for anything more than hasty inroads, and entertain a great apprehension of having their retreat cut off, and their lives thereby exposed.

Neighbours, with such a propensity to plunder, are a serious annoyance to the Kakhetians, and a great impediment to the development of their industrial activity. We may fairly assume that at least 800 men are constantly required for the little outposts established on the border, and yet the most they can do is to give the inhabitants of the village timely notice of the motions of the enemy, so that, upon any alarm of a sudden attack, the whole country must be kept in excitement, as it is impossible for any one to conjecture upon what point the Lesghi may make a sally out of their lurking-places in the woods. Besides this disadvantage, calculations made of the losses sustained by the Kakhetians in oxen, and ransom of prisoners taken by the Lesghi, swell the annual amount of the injury to 10,000 silver rubles.

At last, on the 16th of August, we saw the way clear for a short visit to the mountains. For this we were furnished by the Prince Chevchevadse with an escort of 120 infantry, under the command of a captain and two lieutenants, together with 200 armed Georgians, under the orders of Prince Dsiorjadse himself, who would have derived no less gratification from the expedition if it had given him an opportunity of retaliating on his unruly neighbours. It will not be very difficult to conceive that our researches in Natural History could not be

otherwise than very defective with so unmanageable a convoy, from which it was hardly safe to stray the distance of twenty paces; notwithstanding this, however, some geognostic researches were successfully executed by M. von Behaghel. Our route lay beyond the villages of Almati and Sabué, along the banks of the little river Insoba, and through magnificent forests of walnut, oak, ash, maple, beech, and other lofty trees, with here and there, in the upper region of the hills, an intermixture of the welcome birch, the ornament of the North. A rich, luxuriant flora of subordinate rank adorns the shades of these forests, and, like a wood of secondary order, rises between the enormous trunks to such a height as frequently to conceal a man on horseback. Among other productions, I observed splendid white campanulas, ferns higher than myself, brambles overspreading everything around them, and an umbelliferous plant, with stems as thick as my arm, and leaves two feet and a half in diameter, which may be carried as a parasol or umbrella.

It was on such a spot, 4350 feet above the sea, that we bivouacked before a cheerful fire, so that we were able to reach betimes, on the following day, the limits of the growth of trees, at an elevation of 7314* feet above the sea level. On approaching the limit, hardly any trees make their appearance but the beech, and, last of all, the birch, both of which, even up to the point where they cease to grow, preserve their straight and reg-

* In 1811 I found this limit indicated in like manner by the birch at 6300 feet above the sea: this was on the north side of Caucasus. Vide *Engelhardt's and Parrot's Travels in Caucasus*, Berlin, 1815, vol. ii., p. 127. In 1817, this limit in the Pyrenees (south slope) was 6900 feet for white pines, and 6450 for the fir (*Pinus abies*) upon the north. See Naturwissenschaftliche Abhandlungen, aus Dorpat (*Treatises on Natural History, from Dorpat*), 1823. Index, "Vegetation."

ular shape, but never exceed the height of fifteen feet. As soon as we had pierced through the forest region, by a path admitting only one person to pass at a time, we gained a wider field of view, and separated to climb the steep, rocky acclivities of Kadori. This mountain ridge seems actually to direct the course of the waters of Caucasus on this side, for all the streams, even that on the west side, called the Urzkh-ali, on which Dido, the principal robber-hold of the Lesghi, lies, run northward to the Terek; and still this is very far from being as high as many others near it. The Sakoris-tzveri, or Falcon's crag, a conical peak, very distinguishable even at a great distance, rises very much higher.

Here the soldiers halted to rest themselves, and the Georgians spread themselves up and down, anxious to catch a sight of their foes, while our party, accompanied by the venerable prince, hastened forward along the acclivity, which was composed of a crumbling slaty rock, to reach the summit, which we accomplished in two hours and a half. It is 10,000 feet above the level of the sea: we found it totally clear of snow, nor, unluckily, could we see any higher points, much less any with snow upon them; for a spreading mist, that was now condensing into heavy clouds on the northward, hid every distant object from our view. Still we could look down into the populous and fertile valleys of the Lesghi, though not a soul could be observed in them. The whole range has a wild and dreary aspect from the total absence of trees, though there is a clothing of fresh green herbage upon the less elevated hills; and the *Anthemis tinctoria* is seen on the bare cone of the Sakoris-tzveri creeping to the very top, along with the *Campanula saxifraga*, *Erigeron acre*, and one of the umbel-

liferæ, all with exceedingly low stems and small leaves, but comparatively large flowers.

From this point I had the military station of Sabué bearing 30°, and the church of Yenisseli 25° S.W. by the compass. I was interested to observe here, as I had often done before, the influence which an elevated situation and the rarefaction of the air exercises on the circulation of the blood. I had an accurate watch with a second hand, and in my experiments upon our party found that each gave a different result. This is the natural consequence of temperament, constitution, age, and especially of the circumstance of being used to a residence upon a considerable height, for I had always observed that the pulse of a mountaineer was much less readily affected than my own. It is likewise necessary to the exactness of such experiments that the persons upon whom they are tried should rest for some time, as also that, during the counting of the pulse, they should each be in the same position —sitting, lying, or standing—as this has a decided influence on its frequency. The standard which we took for comparison was the rate of our pulses in Yenisseli, 1245 feet above the sea; and between this place and the summit of the Sakoris-tzveri, 10,000 feet above the sea, there was, for the minute, an acceleration

in the pulse of	M. von Behaghel	from	100	to	125;
ditto	Schiemann	"	75	"	104;
ditto	Hehn	"	70	"	110;
ditto	myself	"	84	"	114.

In former years I had observed a proportionate increase of thirty beats in my own pulse, produced at the same elevation in other mountainous countries;* only with this difference, that then, in spite

* Treatises on Nat. Hist., from Dorpat, Berlin, 1823, p. 278.

of my youth, the rapidity of my pulse was altogether greater in the mountains; but this is easily accounted for by the fact that I was, at that age, accustomed to violent bodily exercise, and consequently may have had less irritability, though more tone in the vessels than now, as it is well known that great and continued bodily exertion generally produces an increase in the strength, but a decrease in the frequency of the pulse.

The mist already mentioned had within the last hour rolled up from the northern valleys of Caucasus, and settled in a rain-cloud upon the mountain tops, whence it favoured us with an unexpected violent soaking shower on our descent. As soon as we were all together again, we pushed forward upon our return, and had the good fortune to enjoy a bright sunshine, by which our clothes were dried, and we reached Yenisseli the same evening, where we were welcomed by our obliging host with a warm meal and some good wine. Two days afterward we took leave of this hospitable place, and turned our faces again towards Tiflis.

CHAPTER IV.

Return to Tiflis.—Barometrical Altitudes.—Expedition Commenced.—Road to Ararat.—Alaverdi.—The Copper Mines.—Mount Agsbouk.— Lori.—Pambak.—Alaghes.—First view of Ararat.—River Abaron.—Monastery of Echmiadzin.—Its Wealth.—Often Pillaged.—Turkish Oppression.—The Persians more tolerant.—Position of Echmiadzin.—Lake Gokchai.—Plain of the Araxes.—Its General Character.—Productions.—Villages.—Legend of Echmiadzin.—Date of its Foundation.—The Three Churches.

We had started from Tiflis with three horses, which we had purchased to yoke under a German travelling-wagon, made in the Wirtemberg colony

of Marienfeld, but we had found much difficulty in proceeding with the latter over the rocky heights between Gambori and Telavi. In consequence of this, we preferred taking hired horses upon our return, which cost us only three silver rubles each per mile. This mode of travelling we found much easier and cheaper than the other. From Gambori to Tiflis, where the roads are even, we got forward with more rapidity and ease in our own vehicle which we had left there.

I had not neglected to examine the levels with the barometer during my excursion into a quarter of the world so little known. They were not, however, the principal object of my attention. I accordingly confined myself to occasional observations with my barometer, on the assumption of a constant height of the barometer in Tiflis, deduced from the mean of the numerous results which I had previously obtained. The horizontal distance from Tiflis was in some directions nearly forty-six miles. It must be taken into consideration that the assumption of an invariable height of the barometer was not strictly correct; still, the measurements will be much nearer the truth than if they were referred, as is commonly done, to a uniform sea-level. In all else the calculations are made upon the principles usual in similar operations, and the elevations above Tiflis are compared with that of the bridge over the Kur, which is 1173 feet above the sea:

	Feet above Tiflis.
1. German colony of Marienfeld and Petersdorf, twenty-four miles east of Tiflis	928
2. Camp of Gambori	2200
3. Highest point of the road between Gambori and Telavi	3968
4. Telavi	1056
5. River Alasani at Telavi	—320

6. Village of Yenisseli - - - —12
7. Tomb of King Levan (Yenisseli) - - 550
8. Zinandaly, the seat of the Prince Chevchevadse - - - - - 595
9. Village of Shakreáne - - - -—204
10. Village of Napereúle - - - - 6
11. Picket of Sabué - - - - - 691
12. Limit of trees on the summit of the mountain - - - - - 6616
13. Peak of Sakoris-tzveri - - - - 8849
14. Deserted monastery on the road to Sakoris-tzveri - - - - - 2143
15. Peak of the Saimtzveri, near Gambori - 4563

We thus accomplished our object of spending the hot season of the year, which we were compelled to sacrifice, in some pleasant and little known quarter of Caucasus, without risk to our health, till the period arrived when all impediments in the way of our journey to Ararat should be removed.

It was on the 1st of September, in the evening, that we took our departure from Tiflis; consequently, just five months after leaving Dorpat, and when half the time allotted to the completion of our enterprise had already elapsed. However great the annoyance I had suffered from this loss of time, in consequence of the restrictions necessarily imposed by it on the execution of my original design, it was something still that all had not been thrown away, as might easily have been the case, and that the cheering prospect yet remained of our actually reaching the wished-for goal.

The distance from Tiflis to the foot of Ararat, that is, to the village of Arguri on its northeastern declivity, is, including rising ground and turnings of the road, about 186 miles—154 to Echmiadzin, and 32 more to Arguri. Though this is an estimate not founded upon actual measurement, I nev-

ertheless consider it tolerably correct, since I found I could calculate with certainty upon making three miles upon an average within the hour, at the rate of which we travelled on that route; so that, according to the notes which I took of the time of our arrivals and departures at every halting-place on the journey out and home, there was a difference of only four miles between the two.

Regular post-stations, kept by Kossaks, are established upon this line at the usual distances from each other, but no farther accommodation for travellers than riding and pack horses. It was not till we were upon our return that they began to furnish teleggas, or posting-cars, here and there, for which horses had to be hired from the peasants at a certain rate. These horses, however, were so unused to harness as to be nearly unmanageable, so that at every descent they were hardly to be prevented from running away. Being anxious for the safety of our instruments, and having a large quantity of baggage and provisions for our intended establishment on Ararat, we hired, for 450 rubles, two Russian carriers with their wagons, each drawn by three horses, merely to carry our necessaries and two of ourselves to our destination. The other three of the party had horses bought in Tiflis for 20 and 25 silver rubles a head. This latter arrangement I subsequently had great occasion to regret, as grass and fodder had become so scarce upon Ararat, in consequence of the unusual heat and drought of the summer, as to cause excessive embarrassment to our military guide, who had charged himself with the duties of quartermaster upon the road. We should undoubtedly have fared much better had we used the Kossak horses at the post-stations for ourselves, and afterward procured others from the natives for our excursions about Ararat.

I took advantage of our progress to continue the series of levels from station to station, between Tiflis and the mountain, so that, if we should succeed in ascertaining the height of the latter above the adjacent country, nothing more would remain to be done but to continue the series to the sea, in order to ascertain the absolute elevation of Ararat as accurately as could be done in the present state of science. I may premise, in this place, that our project was successful, M. von Behaghel having undertaken to make simultaneous observations along the whole line at the constant distance of one station from me, and at the preconcerted hours. This was, moreover, effected without any considerable loss of time, by arranging that the observer, who was in advance, should leave a note at every station for his companion who was behind, stating at what time he expected to arrive, and make his observations at the next. Notwithstanding the uncertainty as to the exact distances, and the variable rate of our progress, as the road was more or less firm or more or less level, we nevertheless contrived to make the times of observation coincide, with the exception of two or three delays of little importance.

The road from Tiflis stretches across a plain about 600 feet above the Kur till it enters the valley of the Khram, a broad but shallow tributary of the Kur, with the remains of a bridge erected at some ancient but now forgotten date. From this point, which is lower than the Kur at Tiflis, the road again tends steadily upward towards the conical hill of Alaverdi, on the south side of which stands the village of Alaverdi, near a copper mine, which is farmed and worked by Greeks. Up to thirty-four miles from Tiflis we observed the country to be under good cultivation, especially the

vineyards. Farther onward, where the heat of the plain begins to decline, and the moisture of the soil increases, trees gradually appear, at first no higher than shrubs, then larger and larger, till at length they reach their full size; just as we observe them affected by the cold of a mountain tract, but in inverted order, declining in vigour and luxuriance with the elevation of the site. At fifty-four miles from Tiflis the first mountain ridge of any magnitude is crossed. It lies just over the Alaverdi, and is known by the Tatar name of Agsböük. At the point where the road is carried over its rocky crest, it has an elevation of 5780 feet above the sea. The southern slope of this chain is reported to be of extraordinary fertility, and to enjoy a mild and salubrious climate. In this respect, however, the district called Lori is said to be particularly favoured. In the times of its earlier possessors, the Armenians, it was thickly planted with villages, monasteries, and castles, and even in the last war between the Russians and Persians, became for some time the place of refuge for the Armenian patriarch.

The road dips into this valley from the heights of Agsböük only to remount more suddenly, and continue its course over a second ridge, the Besobdal, 6636 feet high, into a deep, cool, well-wooded ravine, whence it intersects an open country, in which lie the villages of Kishliak and Hammamlüh, and finally reaches the third and highest crest, the Pambak, an offset of the Saganlúg, between Erzerum and Kars. Although this range has to be crossed at an elevation of 7787 feet, the ascent, at least along the even and firm causeway (the horsepath is shorter but steeper), is very much easier than by either of the former passes.

At about eight miles' distance, reckoning from

the summit of the Pambak, we found a temporary quarantine station, established as a protection against the plague, which prevailed in Erzerum. As for us, who were proceeding from the healthy into the infected territory, we had no interruption to submit to, but, on the contrary, were received with every mark of attention by the officers of health, and provided with a complete quarantine tent to pass the night in. We were now in that part of the country called Bash-Abaran by the Tatars, and Abaran-Pol by the Russians. Towards the north it stretches to the foot of the Pambak, which is a high mountain range running in a south-westerly direction between the rivers Kur and Araxes.

On the west of Abaran-Pol stands a steep, high, and jagged peak, nearly isolated, though yet in connexion with the Pambak: this is Alaghés, the best known and most remarkable mountain of that district. Its height above the plain of the Araxes is, according to the trigonometrical measurement of M. Fedorov, 10,744 feet; consequently, by our system of levels to the Black Sea, it rises 13,628 feet above the surface of the latter. It retains some extensive patches of snow upon the northern side throughout the whole year, and even in the month of August I observed some smaller spots covered with it on the south, where I was told it was never known to melt. It is from Bash-Abaran, in the extreme distance towards the south, that the first view of Ararat is to be obtained on this side, when the atmosphere is clear. I had fancied before that I should get a sight of it as I descended from the Pambak, and I waited with impatience for the enchanting prospect; but the towering mass of Alaghés shut out that part of the horizon, otherwise the first glimpse of Ararat and the adjacent

scenery would present a glorious panorama from these heights. In our case, the delight of the first view which we had from the hollow was much subdued by a thick mist, in which the mountain was wrapped, particularly upon the eastern side; still, I was surprised to find its northwestern declivity much less abrupt than it had been represented in the sketches and descriptions given of it by travellers, so that, in this point at least, I was so confident that the assumed inaccessibility of its summit must be unfounded, that I could not conceal from my companions the hopes I began to entertain of reaching the summit myself.

We took our way to Echmiadzin in a direction parallel with the river Abaran, which, like the Jallal Oglu, already noticed, is obliged to find a passage for its waters through a perpendicular chasm in the volcanic strata of the tract to which it gives a name. We were now obliged to avoid the villages on account of the plague by which they were, or might be visited, and passed the next night in the open air in front of Alaghés, at the foot of a solitary hill, protected only by our tent from the rain, which fell heavily in the night, and recruited by a warm supper of the provisions we had brought with us, and some birds that M. Schiemann had killed. Our fire was made partly with some fuel, of which we had provided ourselves with a small quantity, and partly with materials procured with great difficulty from the deep gullies of the Abaran, for the entire of this neighbourhood is a naked waste.

The hilly plain which we were crossing is uncultivated except on the borders of the Karpichai, as the Abaran is called in Tatarian, on which old castles, villages, and Armenian monasteries were to be seen in the distance. From this we contin-

ued our route into the valley of the Araxes, properly so called, a partially cultivated plain of 20 or 26 miles in breadth, enlivened with some Armenian and Tatar villages, but, above all, with religious houses of the Armenian clergy, among which is the far-famed monastery of Echmiadzin, with its dependant establishments and villages. This is the seat of the patriarch of the holy synod and dignitaries of the Armenian Church; the centre from which issue the radiations of its influence, and towards which the fruits of gratitude and veneration are so copiously reflected from every point of the earth in which its members exist, that the riches and splendour of this metropolitan residence might, under ordinary circumstances, speedily vie with those of the Roman papacy itself. But the sovereigns of Persia have never forgotten to avail themselves of the resources of this mine of wealth, on which they have practised their extortions, either under cover of the law, or as prompted by accident and caprice.

To this the Armenians have hitherto submitted, probably because they have looked upon it as the price paid for the toleration of their worship in the presence of Islam. By submitting to this exaction, they secure to themselves the enjoyment of a far better lot than awaits their brethren in the Turkish provinces of Asia Minor, where they are exposed to many restrictions in the exercise of their religion from which they are exempt under the Persian rule; restrictions so oppressive, that even their laity endeavour to avoid all cause of offence by conforming, as far as practicable, in their costume and mode of life, to Turkish laws and usages. Of this I was once an eyewitness myself: I saw one day, to my great surprise, some personages who had come on a visit to Echmiadzin, and whom,

from the style and costliness of their entire dress, from the turban to the slippers, I should have taken for Turks of quality, but who, as I afterward learned, were Armenians from Bayazed, as far as I remember. And not only the laity, but the clergy too, are obliged to conform to these restrictions in their vestments, and find it absolutely necessary to divest themselves of everything that might betray the Christian ecclesiastic when they are outside of the church.

The Christian churches in Bayazed, Erzerum, and other Turkish cities are said to be without towers or bells, and the prohibition of the Koran against swine's flesh is so strictly enforced upon the Armenians, that the use of this valuable animal is altogether proscribed among them. The Persians have more tolerance: some hogs are always to be found in Echmiadzin, never, however, beyond the precincts of the monasteries. The Armenians in Erivan, and in their villages and religious settlements formed in Persia, are suffered to have regular churches, church processions, and church costume. The present Persian sardar (generalissimo of the army), Hussein Khan, is said to have encouraged the keeping of the Christian churches upon a respectable footing, and even to have attended their worship with every mark of reverence and devotion. Shah Abbas, upon his sudden entry into Echmiadzin, sword in hand, hung up a costly lamp in the church, which is shown there still. Upon the visit of Shah Sada, he never was known to enter the church without leaving his slippers at the door, and having a rich carpet spread for him, just as when he went to the mosque. It is not a little remarkable that Tavernier, who travelled in these countries 175 years before, should have noticed the same difference

which obtains at this day between the two sections of Islam—the followers of Omar and the followers of Ali—in reference to their treatment of Christians.

Echmiadzin lies 3035 feet above the Black Sea, in the great valley which is formed between the mountains of Taurus in Asia Minor, by their separating into two parallel arms, a northern and a southern, near Erzerum. The former sweeps away from Erzerum under the name of the Saganlúg, in a wide crescent, which includes Kars, constituting a gigantic mole, between the waters of the Kur and Araxes, and is lost at length in the plains of Karabagh. It comprises the Pambak Mountains already mentioned, the high and jagged Alaghés, and probably other considerable ranges; for, about the middle of October, before any snow had yet fallen in the hills, I could perceive, from the plain under Ararat, a distant uninterrupted chain, between 83½° and 87° W.N.W., topped with a mass of snow, which could be no other than some portion of the Saganlúg, of extraordinary height. The southern arm of Taurus, which exclusively supplies the sources of the Araxes, separates this river from the Euphrates, that takes an opposite course: this branch terminates, after a short interruption, in Mount Ararat.

A large Armenian village of 500 families lies a few hundred paces from Echmiadzin, and is sometimes also called by this name, but correctly Vagarshabad. Not very much farther towards Ararat is the monastery of St. Gayanne, and a mile or little more, upon the way to Erivan, the small but pretty Shokhagat, as well as the monastery of St. Hripsime. Erivan is situate at the distance of thirteen miles eastward, and somewhat farther still there are several villages and monasteries; among

the latter, Khorvirab, or the monastery of St. Gregory, is the most deserving of notice. The mighty Ararat lies thirty-five miles beyond Echmiadzin; while the Araxes, taking a course directly southward between both, but ten miles on the same side of Echmiadzin, sweeps along with a rapid current, and in a bed of clay-slate and limestone shingle, being about a stone's throw in breadth, and so shallow that it can be passed on horseback in safety.

It is here that the Araxes should receive the Abaran, or Karpichai, as laid down upon our maps, and as I really believed. Instead of this, the Abaran has no actual outfall, but is lost in the numerous canals that have been cut from it for watering the land and the daily use of the inhabitants, so that its original bed is generally dry, and the water all drawn off before it comes to the junction. I did not discover this fact till after I had left that neighbourhood, and therefore cannot aver it of my own knowledge, though I have it from good authority. At a greater distance, that is, at forty miles or more northward of Echmiadzin, and behind some hills, lies an inland sea, named, in Tatarian, Gokchai, but in Armenian Sevanga, from a monastery of that name built upon an island in it. This sea enjoys a high celebrity for sanctity with all Armenians, far and near, on account of the many old, and now partly deserted religious houses on its shores; and with all the rest of the natives for its wonderful stores of fish, of which the salmon-trout is peculiarly esteemed, being dried and carried to great distances for sale. This lake, too, forms, in some measure, the source of the Sanga, which waters Erivan, and is the principal tributary of the Araxes.

The wide and level basin of the Araxes, in

which Echmiadzin is situate, has but little attraction for the eye, if we except the mountains by which it is overlooked. It is entirely destitute of vegetation, especially in summer and autumn, when every blade of grass even is parched up with heat and drought. Trees are only planted about the monasteries and villages; but, except some walnuts and Italian poplars—and these, too, with a sickly foliage and hairy leaves—nothing in the vegetable kingdom has that fresh and verdant hue that one longs to look upon. There are also some mulberries, narrow-leaved willows, apricot-trees, and the gloomy oleaster (Elæagnus), called *pshat* in Armenian, and *igda* in Tatarian, with its long, harsh, almost naked branches and tasteless fruit, so like dates that it is most likely owing to this that it has had the honour of being pronounced a date-tree by at least one traveller. The principal productions of the soil are cotton, the Palma Christi, which furnishes oil for burning, melons, pumpkins, watermelons, tobacco, raised on the banks of the rivers, which are low and marshy, wheat, and barley.

The vine is cultivated to a great extent on the surrounding hills, but is never met with on the plains. The plant, however, which is of the greatest importance to the Armenians, on account of their fasts, is the *Kunjut*, from the diminutive seeds of which a well-flavoured oil is prepared, and used as a substitute for butter. Of all those that are employed as fodder for their cattle, the *Yonja*, as it is called here, is the most valuable, not only because of its nutritious properties, but because it continues to spread and thrive for years, and scarcely requires any trouble but mowing.

The exterior appearance of the villages in this quarter, whether Armenian or Mohammedan, is

but little calculated to produce a pleasing impression. The houses, constructed of clay, have roofs completely flat, and covered with clay likewise, with here and there a small square opening instead of windows, looking generally into the courtyard, where the entrance is found: a clay wall surrounds these courts, and winding passages, without regularity or cleanliness, run in all directions between them. Savage dogs, often of formidable size, dispute the passages with every defenceless stranger, who, in the Tatar quarters, especially if he be a Christian, is exposed to serious danger from his fellow-man, as we ourselves had afterward good reason to know upon many occasions. Villages, such as now described, may well be supposed to display but little of the neatness and picturesque appearance of those of Europe. They are, from one end to the other, from the roof to the ground, so like the earth itself in condition and colour, that they are not to be recognised at a little distance as human habitations at all, and would, without a doubt, be frequently overlooked, as does sometimes occur, if their sites were not distinguished by the trees growing near them. Even in the spring, when the earth is covered with her natural carpet of verdure, it is difficult to view the mass of dull-green houses and their enclosures as anything but a heap of rubbish.

If to all this we add the heat and drought suffered during the summer in this exposed valley, it will not be easy to comprehend why the founders of Echmiadzin, whatever might be the inducements it originally appeared to offer, had not rather selected one of the delicious, healthful, and no less fruitful sites to be found on the Gokchai, or in the valley of Lori. The reason given by Armenian writers for this preference is, that the Saviour, af-

ter his ascension, appeared to St. Gregory, the apostle of the Armenians, where the Cathedral now stands, and on the spot shown, within an enclosure of masonry cased with marble, and enjoined him to have a temple of the true and uncorrupted faith erected there, the outline of which was marked with a ray of light, by which it was traced as by a wand. Hence is derived the Armenian appellation of the monastery—Echmiadzin—the descent of the Only-begotten: the date of its foundation is referred to the end of the third century.

The Tatars call the place Uch-Kilissa, which means the three churches, and is a name given by them to many Christian monasteries; for instance, to one in Bayazed, which has as little claim to this denomination from its having three churches as that in Echmiadzin, though the contrary is often asserted, for neither of them has, properly speaking, more than one church. There is another church near Bayazed, at a small place in the neighbourhood, named Diadina; and if this, together with the forementioned three churches dependant upon Echmiadzin, were to be reckoned, we should then have one too many. It would seem to me more reasonable to suppose that the appellation Uch-Kilissa has some reference to the Trinity, a tenet that may have struck the Mohammedans as constituting a wide distinction between the Christian faith and their own. In this view of the question I am the rather confirmed, from the Uch-Kilissa of Bayazed being styled, by the Armenians themselves, Yeritz-Vank—the monastery of the Three—not the three monasteries, which would have been expressed by Yerek-Vank.

When we were within about twenty-four miles of Echmiadzin, after our last encampment, I took the barometers and separated myself from the rest

of the party, attended only by one Kossak, to stroll silently and quietly over a tract formerly infested with roving parties of plundering Kurds, and a short time before the theatre of extensive military operations, when the armies of the Crescent and of the Cross were drawn up in view of Ararat to dispute the possession of Erivan. Neither village nor monastery was in sight; no one was to be seen at work upon the plain; and a heavy storm which had begun to gather already enveloped Ararat, and settled, like a dense canopy of clouds, over our heads, driving man and beast from the shelterless highways. The only living object to be seen was a monkish-looking traveller upon a Persian horse, who was hurrying from the storm, but who cast a look of curiosity upon us, nodding, and pointing impressively towards the south upon my calling out to him, in Russian, the words Echmiadzin, monastery, Father Joseph. The rolling of the thunder was, however, unheard by me. I gave myself up to the uncontrolled enjoyment of the scene which now lay before me—the goal I had so long sighed to reach; and again, of solemn musings on by-gone scenes of active life and eventful ages.

Could it, indeed, be otherwise? Was I not at the foot of Ararat, the hallowed mountain of the ark, where the soil, though parched and thirsty now, retains the most indubitable traces of those waters which were once commanded to subside from its cloud-capped summit, to leave a resting-place for all that survived of the human race? Did I not stand in the valley of the Araxes, upon the banks where Hannibal sought refuge after having paid the penalty of his superiority on the plains of Italy? Was I not almost within view of the ancient Artaxata, the rich and mighty capital of Armenia, where the Parthian Tiridates assumed the kingly

crown which he had received from Rome, and where he sought to stifle the growth of the first thinly-scattered seeds of Christianity, till, but a little before his death, he himself received the boon of Christian instruction from Gregory "the Enlightener"—a glorious atonement for the murder of the father of the king by the father of the saint? Was I not now before the walls of Echmiadzin, the ancient episcopal seat and palladium of the Armenians, where Christianity, ever since the first century of its propagation, has maintained a habitation, in despite of the uninterrupted persecution, insult, and degradation of its professors—in despite of the unceasing contests between Parthians, Romans, Persians, and Turks for the possession of the soil—nay, more, even in despite of the moral corruption in which its priesthood was sunk? Here that seed was cherished when it might have been choked up by the weeds of idolatry; and here, though crushed and distorted in its earlier growth, it was preserved for a more genial season by a sacrifice of blood and treasure which few other Christian nations would have made.

CHAPTER V.

Arrival in Echmiadzin.—The Archimandrites.—Hospitable Reception.—Full View of Ararat.—The Monastery described.—The Cathedral.—Holy Relics.—The Spearhead.—Hand of St. James.—Wood of Noah's Ark.—Hand of St. Gregory.—St. Paul's Finger.—The Patriarch.—His Reserve towards Strangers.—Ignorance of the Monks.—National Histories.—Traditional Origins.—Legend of St. Gregory.—Schisms.—The Secular Clergy.—General Want of Religious Knowledge.

It was under the influence of such reflections as these that I performed the latter part of my walk and reached the monastery—the door of which was

open to give me a welcome—on the evening of the 8th of September. I had not thought it necessary, when I was at Tiflis, to ask for express recommendations to the dignitaries of Echmiadzin: I contented myself with a private letter from the Armenian archimandrite, Aruthion Alamdarian, a man untiring in his efforts for the enlightenment of his nation, and deserving of the highest praise for his exertions in behalf of the Armenian school in Tiflis, which is almost exclusively under his superintendence. It was addressed to Father Joseph, manager of the domestic affairs of the monastery, in the following superscription: "Varthabed Howsep, Ter Marukian," that is, the Archimandrite Joseph, son of the Ter (secular priest) Maruk. I found him indisposed, lying in a curtained bed, but I handed him the letter, and while I absented myself to make some observations with my barometer out of doors, an interpreter was sought after, for the good ecclesiastic spoke no language but Armenian, which was unintelligible to me.

The interpreter was a young monk of the standing of deacon, who was indebted to the Archimandrite Alamdarian for his education, and the familiar knowledge which he possessed of the Russian language. His open, intelligent countenance and modest demeanour made a favourable impression upon me. When I returned into the apartment I encountered several other archimandrites, aged men of dignified manners,* without any expression of curiosity, or that offensive inquisitiveness which the appearance of a stranger, whose project it was to ascend Mount Ararat, might well have excused. The behaviour of the attendants, who were soon

* A drawing of a monk of Echmiadzin, extremely felicitous in features and costume, may be seen in Tournefort, Relation d'un Voyage, &c., tom. ii., p. 139.

actively employed about us, was in keeping with the bearing of the masters; they received their orders, and obeyed; left their hard-soled slippers always at the door; and either retired to a respectful distance, or, when called on, moved softly over the floor, which was covered with a carpet, in their woollen socks. We seated ourselves round the bed of the sick monk, at regular distances one from the other, and found ourselves almost at a loss for matter of conversation, from the increased solemnity of tone now impressed upon our thoughts, until the question of the Archimandrite Manuel, whether Alamdarian had received me in Tiflis with the proper formalities, put an end to my constraint, and I replied, "No; without any state or ceremony, but with unaffected ease and kindness of heart, as one friend should receive and treat another." Hereupon I inquired, without farther hesitation, whether a lodging could be obtained for myself and the fellow-travellers whom I expected in the monastery or in its neighbourhood; to this it was politely answered that the house in which we then were, if I thought the accommodation sufficient, was at our disposal, and that proper attention would also be paid to our baggage, horses, and followers. These promises were scrupulously fulfilled, and gave us an opportunity of vouching for the hospitality of the monks, of which Tavernier makes honourable mention. At his visit, a bullfight—of buffaloes—was given in honour of his guest by the patriarch, in which two of these animals were killed, and three others wounded. This is an entertainment which, with others, such as throwing of snowballs between the monks, young and old, exhibitions of rope-dancers and dancing bears, it is still permitted the otherwise so serious inmates of the monastery to indulge in at Shrovetide.

This visit concluded, Father Joseph had his bed removed, and when my companions had arrived, ordered tea to be prepared, while the principal apartment was converted into a sleeping place, with the help of carpets, cushions, pillows, and coverlets, and I was shown into a sort of closet, a couple of stories higher, in which was a well-arranged bed, and some grapes and apples hanging, which gave it an agreeable and refreshing smell.

For more than a week we had had no regular rest, so that we were well prepared to enjoy the comforts so liberally provided for us by the friendly monks. My own feelings were still too much excited by the beautiful weather of the preceding day: I wandered into the fresh air to take an uninterrupted survey of Ararat from without the walls of the monastery, for it was now that I saw it for the first time, in its entire magnificence, without a cloud to obscure it, and apparently quite near. I wished to acquire a correct idea of its general form, and of the character of its declivities, as well as to satisfy myself about the existence of the noted chasm upon its northwestern side.

This will be seen in the woodcut facing page 15, made from the sketch which I took, as carefully as I could, the same evening, from the roof of the church in the monastery. All that I have given in this view was visible from the elevation whence it was taken, except the monastery, which is introduced in its proper situation, from the drawing of another traveller, as it would be seen from any moderately elevated spot in its vicinity. I thought I owed it in some measure to my readers not to withhold from them the outline of this justly celebrated monastery, the architecture of which has undergone no alteration of importance for many centuries, as we may convince ourselves from the

journal of Tavernier, and the description and drawing which Chardin had the opportunity of making in 1673.* The same traveller has also left us a view of the little monastery of Gayanne, about a gunshot from Echmiadzin, precisely resembling that which I have given, with this difference only, that it, as well as the other monasteries, is now enclosed within a circuit of walls, as a defence against any hostile attacks, which was not the case in Chardin's time.

The wall by which Echmiadzin is surrounded forms merely a square, and is, as far as I remember (for I must confess that my delight at finding myself in the vicinity of Ararat made me neglect much that was interesting in the monastery), about thirty feet high, built of brick merely dried in the sun, like those used in the fortifications of Erivan, with loopholes and towers at the angles and on each side wall, with two main and three smaller approaches, and having a circumference of about a mile and a quarter. The buildings for the horses and other cattle are partly against the eastern and partly against the southern wall. At some distance within the wall, from which they are separated by open courts and gardens, stand several lines of houses, of one and two stories; these contain the residences of the patriarch (on the west), the archbishop, archimandrites, deacons, and their servants, the strangers' hall, library, and school-rooms; though, at the time of my visit, there was no school. Besides these, there are enormous granaries within the circuit of the walls, as well as the grand refectory, a low, gloomy sort of passage, furnished with tables and benches along each side, both of stone, and calculated for the accommodation of

* Journal of the Travels of the Chevalier Chardin, &c., Lond., 1686, p. 258, plate 9.

more than one hundred persons. Here the whole body of the monks, with the exception of the patriarch and a few very old archbishops, take their three frugal meals (as they are said to be) in common. Proper places are also set apart for a bakery, baths, and a market or bazar, as it is called: here buying and selling, and many different trades are carried on, by persons who live in the adjacent village of Vagarshabad, and only remain in the monastery while they are at work.

In the midst of all, surrounded by the exterior wall as if it were a fortress, and on the site left unoccupied among the buildings just noticed, stands the chief edifice of all—the grand church, built of hewn stone, and representing in shape an enormous die: from the middle springs a low tower with a conical roof; at each of the four sides, too, there is a projection which bears a much smaller tower, so that the entire is in the form of a cross; the more so, as the portion formed by the western projection, and containing the principal entrance, is considerably longer than the others. The position of the Cathedral is such that it has one side presented to each of the four quarters of the earth, the high altar being opposite to the grand entrance, and on the east. The interior is ornamented with pictures relating to sacred subjects of every kind, but worthless as productions of art, with carpets, gilded and plated ornaments, utensils for religious ordinances, chandeliers, and lamps, all oddly intermingled. It is, withal, rather gloomy, the windows being not only small, but walled up, in many instances, ever since the period of some of the early wars.

The most precious ornaments—the real treasures of this monastery, and to which it is indebted for no small share of the veneration with which it is regarded by all Armenians, are the holy relics

which are preserved in the Cathedral, deposited each in its own chest. They are never exhibited but on some particular occasions, as at consecrations, on the offering up of prayers for protection or succour in behalf of particular individuals, whole communities, villages, or monasteries; sometimes, too, out of courtesy to strangers, when they are removed from their depositories and displayed upon a table. This ceremony is always accompanied with prayer, and an imperfect sort of choral service, during which all present are permitted to kiss the relics, which no Armenian would neglect to do, with devout reverence and awe. The objects respecting which I obtained any specific information I shall mention somewhat in detail, as contradictory statements upon these matters are to be found both in Chardin* and Tournefort,† and in some instances I shall be found to differ from both.

First, the head of the holy spear with which the Roman soldier wounded the side of the Saviour; the most precious article of all, but which I did not get a sight of myself, as it had at that time been just removed to another monastery. However, I



was able to procure an exact representation of it from a source on which I could rely, and had it sketched and cut out in paper exactly as I give it here, particularly on account of the wide difference which appears between this and the spear-head of which Tavernier‡ has left a description and a drawing. The entire length is said to be about two spans, the iron much rusted, and the little cross only sunk in it. The privilege of showing due reverence to so precious a jewel

* In the volume above referred to, p. 259.
† Relation d'un Voyage, &c., tom. ii., p. 139.
‡ See his work, already quoted, p. 14, fig. 1.

as a genuine relic is too exciting for the mind of a believer to allow him to consider with apathy the question whether the spear-head at Echmiadzin is genuine or spurious. Porter* expresses his opinion in these words:

"But with regard to the identity of the spear-head of Pilate's soldier, these ancient writers are not all agreed, for they give us notice of a weapon claiming that distinction being in two, if not in three places at the same time. In the eleventh century, they tell us, the real spear-head was dug up at Antioch, and, after gaining a memorable battle before that city for the renowned Raymond of Tholouse, remained in the possession of that hero. Two hundred years after we hear of another spear-head, which had been for ages in the possession of the emperors of Constantinople, and was sold by Baldwin II., as the true weapon, to St. Louis, and so despatched to France. But, to our farther astonishment, though such a relic was actually sent, and seen at Paris, another author virtually denies the facts by asserting the presence of the holy spear at Constantinople after the period of its alleged journey to the West. Besides the testimony of graver writers on these mysterious subjects, Sir John Maundeville may not be a very improper authority to quote in the case of a legend; and in his right wonderful account of his Asiatic travels, between the years 1322 and 1371, he speaks of the holy spear being in France in his time in these words:

"'A partie of the crowne of oure Lord, wherewith he was crowned, and one of the nayles and the spere-head, and many other relikes, be in

* Travels in Georgia, Persia, Armenia, ancient Babylonia, &c. during the years 1817–20, by Sir Robert Kerr Porter. Lond., 1821, 2 vols., p. 189.

France, in the Kinges Chapelle. For a king of France boughte theise relikes sometyme of the Jewes, to whom the Emperour Baldwin had leyde hem to wedde, for a grete summe of sylore.' But he adds, in another page : 'And the spere-schafte hathe the Emperor of Almayne ; but the head is at Parys. And natheless the Emperor of Constantynople saythe that he hathe the spere-head ; and I have oftentyme seen it, but it is grettere then that at Parys.'

"With respect to the spear-head that is preserved at Eitch-mai-adzen, I could gather little of the particulars of its descent from past times to the present, the persons who have it in charge being delicate of communicating on the subject with strangers ; but, as Armenia used to be included by the emperors of Constantinople within the pale of their empire, it is not unlikely that, on the subversion of that state and capital by the Turks, the holy deposites of its temples would be despatched to the safe-keeping of the remoter walls of Eitch-mai-adzen."

Second, the hand of St. James, enclosed in a hand of the natural shape, with an arm of silver gilt : the thumb and fore-finger are bent towards each other, and between them hangs a fragment of the ark of Noah by a little chain : it is a small, dark-coloured, quadrangular piece of wood, in good preservation, and carved upon one surface. It came into the possession of a monk, whose legend I shall take another opportunity of giving, by a miracle, which was the cause of his being canonized.

Third, the hand of the apostle and "Enlightener" of the Armenians, St. Gregory. In this, as in the former case, there is nothing to be seen but the hand of metal, in which the relic is enclosed.

Fourth, the point of one of the fingers of St.

Paul the apostle. This looks just like the finger of a mummy or dry corpse, and is encased in the middle of a little glory, with rays of gold and silver.

Fifth, a bit of the skull of the holy and martyred virgin Hrípsime.

Early in the morning of the next day we received the honour of a visit from three archbishops and a number of archimandrites, who came to give us a formal welcome on the part of the patriarch and entire monastery, and to announce to us that the patriarch would have much pleasure in a visit from us. We entreated permission to be allowed, first, to attend the high mass, which was to be celebrated in honour of his imperial highness, the Tsarevich Constantine, in the Cathedral. The venerable patriarch, in spite of a painful affection of his eyes, officiated in person: he sat, during the greater part of the service, on a chair ornamented with elegant carved work. The presence of the high pastor of the whole Armenian Church, the assemblage of such a number of the highest prelates, all in costly vestments, richly and ingeniously embroidered with gold, silver, and silk; the crosiers, of the noble metals, set with precious stones, which the bishops held in their hands, all contributed, along with the awe and reverence visible in the countenances of the laity, to give this solemn service, thus performed, in a land generally hostile to the Christian faith, an imposing and devotional effect upon the feelings of the true believer, notwithstanding the injurious effect produced upon the external splendour of the ceremony by the singing, which was devoid of harmony, melody, or fervour.

On the conclusion of divine worship we were conducted to the patriarch's, and introduced into a large but dreary-looking apartment in the upper

story, containing no furniture but two rows of seats, placed opposite to each other, in the middle of the floor. Here we saw the patriarch upon a chair, set apart for him, at the upper end of the line, with the archbishops and archimandrites, right and left, below. We were invited to take our places on his right, which, considering the value here attached to outward demonstrations of respect, must be taken as an indication of the honour intended to be shown us. The young monk, already introduced to the reader, stood behind the patriarch's chair as interpreter. The holy prelate's name was Yeprem (Ephraim), and his title Katholikos, which is translated Patriarch only by Europeans; for it is a title implying no particular eminence, but given to the archbishops of some large and distant sees, as those of Jerusalem and Constantinople. He was ninety-three years old, a man of much experience, acquired by travel, which he extended even into India, and gained a high veneration for his vritues, among which, his integrity, disinterestedness, and Christian mildness were pre-eminent.

This high reputation, which had already reached us, gave me room to expect much gratification from this meeting; but in this my expectations were disappointed. The former political connexions of the monastery—its alternate dependance, now upon one, and now upon some other potentate, to whom, for the sake of the very existence of the establishment, it was necessary to observe a blind submission and elaborate deference, have, in the lapse of centuries, had the effect of destroying all candour and openness of character in the monks, and introducing mistrust, disingenuousness, and a selfish devotion to personal interests in its stead, so that it is impossible for a stranger to overpass those bounds of Oriental formality and cold politeness

which are here so strictly drawn and observed. The conversation of the patriarch, consequently, was confined to indifferent subjects; and when I touched upon the ultimate object of my journey—Ararat, which should have found as much interest in his eyes as in mine—I received only apathetic and chilling replies, scarcely less discouraging than the few half-uttered remarks with which I was favoured by the rest of the ecclesiastics. This made the state of feeling into which I was unexpectedly thrown so intolerable, that the leave-taking, at which I received the blessing of the worthy old prelate, was the most agreeable part of the visit, in a twofold point of view.

In the evening, several of the archimandrites spent some hours with us over a cup of tea, with which our kind host, Father Joseph, regaled us; still, I saw that it was impossible to give that turn to the conversation which it might be expected to have taken when persons from distant countries, and of so many various conditions and sentiments, come together. With the exception of the Deacon Abovian, there were only the Archimandrite Manuel, and the librarian, the Archimandrite Ohannes, who could speak Russian; all other European languages were unknown in the monastery. This, however, is not to be wondered at, if we reflect upon the retired and sequestered life passed by these ecclesiastics, many of whom have never been beyond the walls of Echmiadzin during a monastic life of half a century; still, this makes it rather the more extraordinary that they should have totally neglected the study of the ancient tongues, so that I was completely disappointed in the supposition I had entertained, that, in my ignorance of the Oriental languages, I might have recourse to my Latin.

This total indifference to the study of the Greek and Roman classics, several of whose works are preserved in their library in the monastery, is no less to be deplored than wondered at, as such pursuits would seem more calculated than any others to relieve lassitude and dissipate those worldly anxieties so likely to engender the vices which too often beset men living under the restrictions and confinement of a cloister. Their only literary occupation was the study of the history of their country, if it really can be deemed a literary employment for an Armenian monk to read the histories of his nation in the Armenian tongue, without the least idea of intelligent criticism, and to receive with blind submission all that their authors assert, either upon their own authority or that of worthless traditions, with all the errors and variations of careless transcribers, or, at least, to represent them to the people as positive and undoubted truths, whenever it suits their interest or hierarchical policy to do so.

The earliest and most highly valued of their historical sources is the work of Agathangægos, who is said to have been private secretary to King Tiridates, and who, consequently, must have flourished in the third century of our era. As the Armenian alphabet was not known before the fifth century, when it was introduced by Varthabed Mesrob, to whom, as it is alleged, it was revealed in a dream by a hand which traced the characters before him, we must accordingly suppose that Agathangægos wrote his book either in Armenian, with Greek letters, or, as is more probable, altogether in Greek. Still more celebrated is the Chronicle of Moses of Chorene, which has been frequently published in Latin and Russian, as well as Armenian.

On the evidence of these and other historians of

less repute, the Armenians believe that the origin of their nation may be carried back to Haigh, a descendant of Japhet, who emigrated into the countries about Mount Ararat at the time of the building of the Tower of Babel, and became the founder of the kingdom of Armenia; whence the natives call themselves, not Armenians, but Haigh. The former name was given them by strangers, from an Armenian king, Aram, who is said to have gained himself a great name in war. It is from the four brothers of Haigh, who accompanied him in his migration, that the Georgian and Caucasian tribes are supposed, by the Armenians, to have sprung.

Next to the history of their early origin, the record of their conversion to the Christian faith is justly considered of the highest interest; and, besides, the way in which it is detailed by their writers is a subject of their firmest belief. The circumstances attending it are represented to have occurred in the following manner: An Armenian prince, of the name of Anagh, of the royal race of the Arsacidæ, suffered himself to be persuaded by a certain king of Persia to cut off Khosref, king of Armenia, by assassination, but soon afterward lost his own life. Khosref had an infant son who found protection in Rome, and was brought up at the imperial court: this was Tiridates, or, as he is called in Armenian, Tridat, who was subsequently so renowned. Anagh had a son of tender age, likewise, who was carried by his nurse into Cæsarea, in Cappadocia, to the Christians, who reared him in the Christian faith, and baptized him by the name of Gregory, or Gríghor, as it is written in Armenian.

Gregory, on growing up, felt himself strongly attached towards Tiridates, whom he sought out at Rome, and, without making himself known, served him with such zeal and fidelity as to secure his

confidence. He attended him also when he returned with succours from Rome, to deliver his country from the Persian yoke, on which occasion the prince received his crown from the Emperor Diocletian, in the year 286. Armenia being still a pagan country, Tiridates went to offer up thanksgivings in the Temple of Diana for his success; and, in order to give additional splendour to the ceremony, required Gregory to decorate the head of the goddess with a wreath of roses and laurels; but Gregory refused, saying, "I bow down before the throne of heaven and earth, and not before any work of human hands." By this refusal, as well as by disclosing, at the same time, who he was, he incurred the unrelenting anger of Tiridates, by whom he was exposed to fourteen different kinds of the severest tortures, in Ardhashad. After this he was thrown into a pit with wild beasts, in which he continued for fourteen years, escaping death by constant prayer. The place of the ruined city is now marked by the large and widely-venerated monastery of St. Gregory—in Armenian, Khorvirab, or deep pit; where the scene of his sufferings is still pointed out, along with a stone in which are two depressions, supposed to have been formed by the elbows of the martyr, on which he supported himself in prayer.

The story goes on to say that, about this time (three hundred years after Christ), forty Christian maidens, among whom were two of noble birth, Hrípsime and Gayanne, had fled to Armenia and Caucasus, to escape the persecutions then exercised on the Christians. In the dominions of Tiridates, however, who was still a heathen, they only experienced still greater cruelties than at home; the more so as the king had fallen violently in love with Hrípsime, whose portrait had been sent him

from Rome. Yet all his advances were repelled by the virtuous maiden. The sufferings and martyrdom of these holy virgins have an honourable memorial in the three religious houses of Gayanne, Hrípsime, and the pretty little Shokhayat, which stand near each other, at Echmiadzin. At the present day, however, these are not nunneries, but monasteries, and inhabited by monks, although that of Hrípsime is called a nunnery by Tavernier;* and even Morier speaks of five nunneries in the province of Erivan, of which nothing was known at the time of my visit to Echmiadzin—a fact confirmed by the Protestant missionary Zaremba.†

As a punishment for his hostility to the Christians, Tiridates, with the nobles of his kingdom, was visited from heaven with a heavy affliction; for, according to the legend, he was transformed into a hog (perhaps a figurative expression for some severe and disgusting disease), the consequence of which was repentance for his former courses, and an earnest desire for heavenly aid and consolation. He now discovered that Gregory was still alive, and had him taken out of the den and set at liberty; while Gregory, on his part, recalling to mind the heavy guilt incurred by his own father in the murder of the father of Tiridates, found a source of satisfaction and happiness in being able to convert the heart of the king, who was now relieved from his bodily affliction by the preaching of the Gospel. Gregory soon after baptized Tiridates and all his subjects in the Christian faith; built churches and religious houses; selected and ordained a priesthood; established schools;

* Les Six Voyages, &c., tom. i., p. 11. [The same traveller bears witness to the numerousness of Armenian nunneries in tom. i. (12mo, Paris, 1724), p. 446.]—Ed.

† Magazine for the latest History of Evangelical Mission and Bible Societies (in German), 1831, Part III.

and did his utmost to enlighten the people, both by precept and example. Hence his appellation of Gregory the "Enlightener."

For the rest, the history of Armenia presents but a melancholy picture to the friend of humanity. Rapacious neighbours, the enemies of Christianity, found a theatre for their unheard-of cruelties and oppressions in this beauteous land, the inhabitants of which were equally exposed to the outrages of Paganism and of Islam. Still, this picture is not altogether destitute of its lights and brighter points of view; courage, piety, and faith shine forth in the characters of the noble Patriarch Joseph and the brave Prince Vartan in the fifth century, who in battle and in the moment of death were found ready to testify their devotion to a holy cause. Yet the people, when their nobles were sacrificed, saw themselves again a helpless prey to the enemies of their welfare and religion. The painful consequence of this was the farther degradation of the priesthood, and dissensions in the bosom of the Church, which exist to the present day. Thus there is an independent Catholikos at Sis, in Cilicia, and another, who has maintained himself in this dignity for 700 years, on the island of Akhthamar, in the Lake of Van, under whose control the Armenians of Constantinople even placed themselves in 1831, after the deposition of the patriarch whom they had received from Echmiadzin.

Nay, there is no small portion of the clergy, and laity also, who have attached themselves to the Roman Catholic Church, to the pretensions of which the Armenian priesthood in general have been uniformly opposed. This defection was occasioned, about 100 years ago, by Varthabed Mekhitar, a man inspired with the generous design of giving science, civilization, and religion a perma-

nent influence over the people. But this was not to be accomplished in Armenia: his views were resisted by the clergy, by whom he was forsaken and persecuted, till at last he was obliged to throw himself into the arms of the Roman pontiff, whose protection was only to be purchased by the recantation of those articles of faith in which the Armenian Church differs from that of Rome. He was subsequently received into the Benedictine order in the Morea, but afterward withdrew to the island of St. Lazarus, which was given up to him by the Venetians.

This certainly was not the way to induce his nation to take a more purely evangelical view of the doctrines of religion. To Varthabed, however, must be awarded the high praise—and it has never been withheld even by the orthodox of Echmiadzin—of having published many useful and edifying books in Armenian, correctly and beautifully printed, under his own inspection, and in his own printing establishment in Venice; a praise which the congregation of Mekhitarists continue to merit by their exertions to this day. Still it is to be deplored that these works, and especially the Holy Scriptures, are almost inaccessible to the majority of the people, in consequence of their ignorance of the written language, which differs not a little from the modern vulgar tongue, and also as the orthodox Armenian clergy in Echmiadzin concur with the Roman sectarians of Venice in the opinion that the publication of the Bible in the vulgar tongue is an inadmissible innovation. This will explain the want of success attending the generous efforts of the missionary society of Basle, who had formed an establishment in Shusha, beyond Caucasus, for printing a translation of the New Testament, which had been made under their direction, into the popular dialect of Eastern Armenia, though they had made pressing applications to the Synod of Ech-

miadzin to be allowed to lay it before them for their inspection and approval.

This solitary fact is enough to explain what the Armenian requires before he can be divested of the oppressive coil of superstition and low selfishness in which a thousand years of suffering have bound him. It is a bold and dispassionate examination of himself in the unsullied mirror of the divine revelation; a clear perception of the designs of Providence in the healing dispensations proffered to mankind; and, preliminary to all this, a regeneration of the priesthood, whose condition exposes them to the corrupting influence of hostile elements, by which they are estranged from their proper duties. Of this we need seek no farther proofs than the mode in which their secular clergymen—called, in Armenian, *Ter*, spiritual master or priest—is appointed, to be convinced that the cure of souls, in its proper sense, on which the development of genuine piety in every Christian community must depend, can never be made matter of weighty consideration with them. Every laic, provided only he be chosen by the congregation, and have passed fourteen days in the prescribed fastings and ritual observances in a church, may get ordination from the bishop, and may read mass, baptize, confirm, marry, give extreme unction, and has authority, too, to forgive sins!

This shows the urgent necessity for the establishment of an ecclesiastical seminary, a genuine national Armenian institution, where the pupils should be under the control of the Synod of Echmiadzin, and which should enjoy the confidence of the nation. If a foreigner should be selected to direct the studies in history, geography, and the elements of mathematics, he ought to confine himself strictly to scientific instruction; the theology should be left altogether in the hands of Armenians,

whether members of the secular or regular priesthood, and, where possible, to those only who either had never visited foreign countries, or at least not for some time before, in order to avoid all appearance of a tendency to innovation, which would instantly excite suspicion in the minds of the lower orders. A character for consistent religious conduct, and a comprehensive acquaintance with the Scriptures, are the qualifications requisite in such religious teachers; and, according to my experience and conviction, it would not be altogether impossible to find two or three men with these ad vantages.

The Bible is a book which, for the anxious inquirer, contains the best commentary within itself; consequently, the introduction of the Bible into Armenia requires no aid from the erudition of foreign academies; but, if the task were only committed to proper hands, theological instruction might take an independent position, and the unpretending seminary might, at a future period, become an establishment for the prosecution of more advanced theological studies. What a blessing for the people if, at the end of, possibly, not more than three years after its foundation, its pupils might be found able and willing to undertake the cure of souls, and to direct the eyes of the forlorn and erring to Him with whom alone there is rest, and salvation, and blessing.

After these reflections on the present condition of the Armenians—the nation which has had possession of the countries adjacent to the mountain of the ark during the memory of man, and which, though surrounded by hostile nations ever since the revelation of Christianity, has clung steadfastly to the strong pillar of the faith—we shall now look to the progress of our enterprise, and return to our companions.

CHAPTER VI.

The Deacon Abovian.—The Expedition starts for Ararat.—The Ford of the Araxes.—Character of the Plain.—Traces of the Deluge.—The Blackwater.—The Cochineal Insect.—The Dye, how procured.—The Nests.—Foot of the Mountain.—The Village of Arguri.—The Sardar's Villa.—Traditions attached to Arguri.—Its Name.—The Plague.—Advantages of Bayazed as Headquarters.—Its Pasha.—The Author's Introduction to him.—Promise of Assistance.—Monastery of St. James.—The Archimandrite described.—The Expedition established on Ararat.

The travelling party had received an addition in the monastery: this was in the person of the young deacon already mentioned, whose name was Khachatur Abovian—Khachatur, the son of Abov—and whose services were kindly placed at our disposal by the community for the period of our visit to Ararat. As a member of the monastery, and specially deputed by it, he was to introduce us to the other Armenian establishments, and to recommend us to their attentions. He was also to serve us as interpreter, for his acquaintance with the Armenian, Russian, Tatarian, and Persian languages made him almost indispensable to us. The young man had, besides, expressed his desire to accompany us in so earnest and ingenuous a manner, that I saw he would take such a degree of interest in our undertaking as must contribute materially to its ultimate success. My expectations were not disappointed; from the first hour to the last, he showed by his behaviour, on every occasion, that he regarded our concerns as his own. He established a claim on our respect and gratitude by his earnest thirst after knowledge, his modesty, self-denial, and pious feelings, no less than by his penetration, his cour-

age, and his perseverance. We were likewise attended by a hired guide and a couple of volunteers, but only to the foot of Ararat.

With this accession, we started from the great monastery on the 10th (22d) of September, at 10 in the forenoon, bidding adieu to the patriarch, his twelve bishops and archbishops, more than forty archimandrites, and a host of deacons. We took our way southward by the neighbouring little monastery of St. Gayanne, and through two Armenian villages, in the direction of the Araxes, across a plain partly cultivated and partly uncultivated, but overgrown with grass and herbage—in fact, a steppe. For me, my eyes and all my thoughts were ever directed to the mountain reposing in brightness and majesty before us. My mind was filled with its presence, its splendour, and its magnitude. The laden wagons rolled heavily on, accompanied by ourselves and our Kossaks: our two Armenian friends presented a striking contrast with the rest, being in their holyday attire, completely armed, on active Persian horses, and showing the excitement of their spirits by racing, sham-fighting, and shouting; while, for myself, I felt my heart filled with indescribable joy and silent gratitude to Him who had vouchsafed me such a sight!

At four o'clock we had got to the left bank of the Araxes, and had to seek a passage through its rapid stream, which is without either bridge or ferry for many leagues; nor has it even any approach from the plain to show the place where it is to be forded; and, to come at it, the traveller is obliged to leave the main track from Erivan and Nakhichevan, which runs almost parallel with the Araxes, from five to ten leagues distant from it. No one of our attendants was sufficiently acquainted with the locality to be depended on so far that we

might risk our instruments in crossing; we therefore made for some huts which we discovered at a little distance, though almost concealed among some bushes, but found the inmates so little disposed to assist us that we determined to run all risks. However, we met with a Tatar, poorly clad, and dirty in appearance, but who proved to be both intelligent and obliging, and who led us, about three quarters of a mile farther on, to a place where the stream was broader, but more shallow, as its channel was partly filled with a wide accumulation of sand and stones. The Tatar here requested the loan of one of the horses for the purpose of examining the ford, as the bottom was not to be depended on, from changes in the channel of the river. It was not till he had arrived at the other side that the thought occurred to me how easy it would have been for him, had he been as treacherous as some others of his tribe, to ride off with the horse before our very eyes, and that without any danger of pursuit. But I dismissed the injurious suspicion: the faithful Tatar returned as soon as he had satisfied himself of the safety of the ford, and assisted us, with every appearance of anxiety, in loading our strongest horses with our effects, which we had taken from the wagons, lest these might be overturned, and which we carried over in this manner, one horseman leading, and two others supporting each of the loaded horses; for the current was strong, and the water reached above their girths. We were all safely landed on the other side, with our baggage, in about an hour. We made suitable acknowledgments to our Tatar friend, and dismissed him to escort one of our attendants back again to the left bank.

The right bank of the Araxes is covered with a somewhat extensive growth of low bushes, through

which openings are cut in various directions, merely, however, for footpaths or very narrow passages. A short time brings the traveller again into the open plain, constituting the level bottom of a wide basin, almost totally uncultivated, and consisting, for the most part, of a barren sandy or clayey soil, which bears only a few stunted solitary shrubs; but not a tree is to be seen, far or near. This tract exhibits such indubitable traces of having been once under water, that the most uninstructed person can hardly fail to arrive at this conviction, unless under the influence of some prejudice, when he takes a survey of the plain, so level and regular is the surface of the ground, only intersected now and then by a longitudinal depression, as if it had been the channel of some rivulet in former times; and in numerous places, stretching away for miles so even and smooth, that nothing but the gradual subsidence of a large body of water could have effected its conformation.

At half past seven in the evening we reached a little stream which is known by the name of the Blackwater in Tatarian, Armenian, and Russian;* a name which it seems to deserve, as its channel is deep, blackened with moor-earth, and rendered still more striking by the reeds with which its banks are covered to the distance of some hundred paces, and which keeps the water in constant shadow. Several other Blackwaters are met with in the plain of the Araxes, between it and Ararat, all of the same character, and abounding in fish. These are, perhaps, nothing more than small collateral branches of the Araxes, which make their appearance in the lowest points of the bottom of its wide basin, to return to it again under ground;

* This stream is generally denoted in maps by the Tatarian name Kara-su.—Ed

and, in this view, can only be the remains of a more extensive inundation, which once covered those countries, and afterward found an outlet. These streams afford the Tatars and Armenians inviting situations for their villages, more particularly as they present a soil sufficiently humid for the cultivation of rice, and capable of being laid under water at certain times by suitable contrivances.

Evening was setting in as we arrived at the Blackwater: we had, accordingly, to look about for a halting-place for the night; but we resolved to employ the time yet to spare before night was totally closed in, in crossing the river, that this operation, which was attended with loss of time and some danger, might not interfere with our progress the following day. There was a little floating-bridge on the spot, formed of some pieces of timber, and interwoven with boughs, sufficient merely for foot-passengers, but too frail for a beast of burden, and quite inadequate to the weight of a laden wagon with three horses. By the help of some bushes, which we found near, but still more with a large heap of reeds, we gave it the requisite stability and buoyancy, so that by carrying the heavy chest of instruments ourselves, by loading the lighter part of the baggage upon the horses, and taking the wagon empty, with one of the horses yoked in it, we got them all over in safety. We ourselves crossed on foot, leading our horses after us by the bridle. As soon as we had waded through the reeds, which grew in great quantity upon the swampy margin of the river, we directed our course to a spot of rising ground, where we resolved to halt for the night; so, pitching our tent and kindling a fire, we composed ourselves to rest till the following day.

As the morning broke we were gratified at be-

holding the summit of Ararat towering in full distinctness and grandeur before us in the southwest. We could not resist availing ourselves of this favourable moment to take a sketch of the mountain. While M. von Behaghel was occupied with his pencil, my attention was attracted by a number of cochineal insects, some of which were creeping about on the dry sand and short grass, but the greater part were collected together in large nests, round the roots of a short, hard species of grass—the *dactylis littoralis*, which grows in large quantities in the vicinity, where they might be gathered in abundance. This is a discovery of some interest to the commercial speculations of Russia, and one which, under proper management, might become a source of profitable occupation to these provinces. The value of these insects is well understood in Persia, where they are used very generally for dyeing scarlet, and, in fact, throughout every part of the East; the prepared insects being sold, sometimes, at a very high price. The scarlet dye employed in Europe is produced from the American cochineal insect, as it is called, which is found in Mexico, St. Domingo, Jamaica, Brazil, and other countries, living above ground, upon several species of cactus, whence it derives its zoological distinctive name, *Coccus cacti*. The Persian insect is somewhat different, probably the *Coccus Polonicus;* so called because it was produced in Poland, whence great quantities were drawn before the discovery of America. The male, as is well known, is a winged insect, not used at all in dyeing; the female is roundish, about the size of the kernel of a cherry, provided with very short legs for creeping. She is quite soft, like a berry, and of the finest dark amaranth colour throughout, though soft and subdued, even in

the strongest light, owing to the wrinkled and somewhat velvety surface of the insect. When dried, they shrivel up to the size of a grain of millet, and become covered with a bluish mould. The true scarlet colour is produced by infusion, with the addition of acids, just as the purple is by a solution of potash.

The nests, which we found imbedded among the roots of the grass to which I have alluded, consisted of three, four, ten, and twenty very hard cells, formed of a paper-like material, to suit the size of the animal, and irregularly arranged against each other. After falling into the chrysalis state, the insect dies in the winter, and the young ones make their appearance from the nests in the spring. I did not fail to make a report of this discovery, upon my return, to the commander-in-chief, Count Paskevich, of Erivan, and to present him with some specimens of the plants and insects, as I also did to the chamberlain, M. Pelchinsky, who was making the tour of these provinces at the time, to examine into their industrial resources, under a commission from the government.

It was near nine o'clock before the occupations of the morning were over, and we were ready to proceed on our journey. The ground across which we travelled now was no longer the even horizontal plain on the borders of the Araxes. It rose, at first imperceptibly, then more rapidly, with alternate elevations and depressions, and it soon became evident that we were now treading the base of the mighty mountain itself. Our path—for there was no road, properly so called, to guide us—soon became stony and much steeper, so that the horses could hardly get forward with the wagon; and, seeing that large masses of rocks were scattered in every direction about us, we were obliged to

admit that to advance any farther in this way was impossible. We had directed our course for the Armenian village of Arguri, the only one upon Mount Ararat. It contains about 175 families, with a well-built church, a pastor of its own, and a village elder or chief of respectable condition. All the houses are of stone, and, agreeably to Eastern custom, have flat, level roofs, of mortar covered with clay, holes for the admission of air and light instead of windows, and courtyards enclosed with stone walls. The inhabitants live by the breeding of cattle and horses, and from their corn, which, however, is not raised in the immediate vicinity, on account of the stony nature of the ground. The richer class have vineyards adjoining the village.

But the real treasure of this settlement, its very life-spring, is the little rivulet which has its source in one of the glaciers of Ararat, and finds a passage downward, through the great chasm on its northeast side, to the village, which is situate on the level ground at its outlet. Besides this, there is another rill, of exceedingly fine drinking-water, which springs out of the rocky side of the same chasm a few hundred paces above the village. There it is caught in pipes and conducted into stone troughs for the use of the cattle when they return from the pastures, which are without a tree to shade them from the scorching sun, while a number of young persons are generally seen collected in the evening, with their pitchers, under the cool brow of the rock, drawing water.

The temperature of the air about Arguri is much more genial than in the valley of the Araxes; for, though its elevation bears no proportion to this difference of climate, still the vicinity of the snows on Ararat, from which refreshing currents of air are

constantly streaming, produces a general and decided effect in cooling and purifying the atmosphere. For this reason Arguri is often visited by persons of quality from Erivan, who make it their residence during the hottest season of the year. Even the Persian generalissimo, Sardar Hussein Kkan, has gone so far as to build himself an elegant summer retreat upon the height opposite Arguri, with numerous apartments for himself, his family, and the officers of his household, and with all the conveniences which Asiatic luxury can require. He has also taken precautions for its security by surrounding it with a wall and towers. Since the cession of this territory to Russia, the beautiful edifice here spoken of has remained untenanted and neglected, and, unless it fall into the hands of some wealthy lord and admirer, must soon sink to ruin.

In a religious point of view, Arguri has an especial claim on the veneration of every devout Armenian. This is the place, according to tradition, where Noah, after he came out of the ark, and went down from the mountain with his sons and all the living things that were with him, had "builded an altar unto the Lord, and took of every clean beast, and of every clean fowl, and offered burnt-offerings upon the altar."—(Genesis, viii., 20.) The exact spot is alleged to be where the church now stands; and it is of the vineyards of Arguri that the Scriptures speak (Genesis ix., 20) when it is said, "And Noah began to be an husbandman, and he planted a vineyard." It is a remarkable coincidence that the building of the church must be referred to an unascertained, but still very remote date, and also that the Armenian name of the village contains a distinct allusion to that occurrence: *arghanel*, in that language, means to set or plant,

whence *argh*, he planted, and *urri*,* the vine; so that the tradition cannot be a modern fabrication, at all events.

It was near one of these hallowed vine plantations, but about three miles below Arguri, that we were brought to a halt, at eleven in the forenoon, and obliged to deliberate upon measures for conveying our effects onward in some other way than in wagons, as hitherto. This could only be effected by having recourse to the villagers, and in this Providence seemed to favour us. The plague, which had committed great devastation in the environs of Erivan, and in the city itself, where it had never made its appearance during the period of the Persian rule, was now spreading with such rapidity, that most of those whom we met upon the highways were affected by it. This hospitable little village upon Ararat, even, had not been spared; and though the visitation had not been so awful there as in some other places, still there were yet several houses, here and there, with convalescents. This was admitted by some of the inhabitants with whom we had spoken, but who, through fear of the quarantine regulations, would represent the danger less than it really was.

I rode forward with Abovian, our interpreter, pulled up in an open part of the street, and requested the village elder to be called. This person's name was Stepan Aga: he had obtained some consideration during the supremacy of the Persians, and, along with it, the honourable and heritable title of Melik, or, as it may be rendered, governor. His outward bearing inspired me at once with confidence; still more, his instant and decided arrange-

* The common Armenians pronounce Aghuri, and the Tatars Akhuri. Most foreigners pronounce and write the word as the latter; but the old authors have it Arghuri.

ments for our relief. He directed that a small herd of fifteen or twenty oxen, that were feeding outside the village, should be despatched for our luggage, with ropes to secure it; and he set out with me himself to the place where I had left my companions and our effects.

Water was now fetched in our camp-kettles, and some chloride of lime dissolved in it: with this the villagers who assisted in changing our baggage were directed to wash their hands and sprinkle themselves; a proceeding, however, for which they appeared at first to have little inclination, but which they set about without farther difficulty when our Kossaks did it before them, and undertook to assist them. The strongest of the oxen, of which we only required eight, were then taken apart, and likewise well drenched, ropes, and harness, and all, and, in God's name, laden with our effects.

While the peasants were left to proceed quietly to the village, Stepan Aga gave us a friendly invitation into his vineyard, and seemed highly gratified when he saw us retire from the heat of the sun under the cool shade of its foliage, and quench our burning thirst, to our hearts' content, with the delicious grapes just ripening on Father Noah's vines. We soon felt ourselves recruited in spirits, and followed our baggage into the village without any apprehension, as all communication with persons or goods was carefully avoided; and as soon as I had obtained from Stepan Aga the necessary information as to the lodging to be had on Ararat, I felt my anxiety so completely relieved, that I dismissed our somewhat costly but faithful and indefatigable Muscovite wagoners.

In order to carry on investigations in natural history in a mountainous district with ease, security, and not too great an expenditure of time, it is

indispensable to find some station on it, or at least in its neighbourhood, where the traveller, his attendants, and provisions, with the implements and apparatus necessary to his pursuits, may be lodged in safety. I had directed my attention particularly to this point when I was at Tiflis; and, after some time, having had the honour of making the acquaintance of the Prince Chevchevadse, who had gained such credit during the Persian war for the construction of a military road from Erivan to Bayazed, and other local improvements, I endeavoured to gain some information from him respecting Arguri, and the facilities it might afford for our observations; but the ravages made by the plague in the district of Erivan tended so much to make all such data unsafe, that I resolved, at the same time, to verify whatever statements I received in every way I could.

Bayazed, the capital of the Turkish pashalik of the same name, only twenty miles south from Ararat, affording many advantages which it would be impossible to obtain in a small village, and being still uninfected by the plague, which had hitherto presented so many obstacles in the way of our plans—Bayazed was the point that seemed to me in the highest degree worthy of consideration, and especially on the following grounds: At the time of my stay in Tiflis, besides the Seraskier of Erzerum and several other pashas, there was also the Pasha of Bayazed, Mehemet Bähälühl, detained as a state prisoner, but not in rigorous confinement, so that I had no difficulty in obtaining access to him, and forming an intimacy with him, the circumstances attending which induce me to take a short retrospect of my intercourse with him in that city.

With the desire of introducing myself in the

most frank and unceremonious manner to the acquaintance of this Oriental grandee—who enjoys this important mark of superiority above the other pashas, that his pashalic is hereditary in his family—I waited for no presentation or introduction through any one, but stepped one evening, between five and six, into his residence as a perfect stranger. The attendants whom I encountered in the anteroom gave me to understand that he was engaged just then in prayer, but offered to announce me. This I declined, and sat down to wait. Presently two doors were thrown open, and I perceived a man in the third room kneeling upon a carpet, with his face towards one corner, in silent and earnest devotion, occasionally changing the kneeling posture for the upright. After an instant's delay, an attendant motioned to me, courteously, to enter: that was the pasha, and my presence would not disturb him. I hesitated, however, to do so, and remained where I was till he had finished.

The pasha now rose—a man of tall, slender make, in the costume of an Oriental satrap—advanced with a light and rapid, but firm step—a rare combination of unembarrassed and manly dignity—greeted me with a welcome in his own tongue, and with an expression of countenance so gracious and so free from affected politeness, that, in spite of my ignorance of his language, I could not doubt that I was a welcome visiter; so I entered with him into the closet where I had seen him at prayer. A row of cushions was laid upon the floor along two of the walls; we seated ourselves opposite to each other, where we had full time to show how much we felt at a loss before the interpreter arrived, as neither could speak one word intelligible to the other; but I can aver that I never felt more at my ease with a stranger. The pasha en-

deavoured to take advantage of this interval by making me comprehend a few sentences in Turkish, but to no purpose. This he did with somewhat of anxiety so natural and so simple, that it was impossible to entertain one thought of constraint or etiquette. As soon as the interpreter appeared, I explained briefly who I was, and the purpose of my visit. The most essential, and obviously the most agreeable part of the communication to him was, that both myself and my enterprise were under the directions and patronage of the mighty Emperor Nicholas, for whom he expressed his sincere and heartfelt respect in the most unequivocal terms. He had learned to make a just estimate of the political conduct and spirit of his enemy and conqueror.

The attendants presented pipes and tobacco; the pipes having, according to Turkish fashion, a small clay head with a long tube. They were lighted with a bit of hot charcoal, and a little tray was used to protect the carpet. We afterward had coffee, without milk, served in beautiful small porcelain cups upon goblet-shaped silver salvers instead of saucers. I had sugar offered, with milk; but the pasha took his without any addition, as the Turks in general do. We passed a couple of hours in an agreeable conversation, and then separated, with a mutual desire to meet again. I often repeated my visits, both by myself and with my fellow-travellers, and always found in Mehemet Pasha the same characteristic qualities that had secured for him my respect and attachment at first. In this he stood in advantageous contrast to the other pashas whom I saw with him. He also favoured us with a visit, when he amused himself with viewing the stars through our telescope; but what seemed to give him most gratification were

my pistols with percussion locks, the effect of which drew from him expressions of surprise and delight. He would not believe that they could be actually discharged without powder; so I put a little pellet into one, placed a cap upon the nipple, and desired him to make a trial; he had a candle fixed at some distance, and gave at once a proof of the strength of the priming and his own skill by extinguishing the candle.

A circumstance which struck me upon my first visit to this personage was, that notwithstanding the interest he took in everything else, he should evince so little sympathy with me when I spoke to him of Ararat; and when I went on to make some inquiries regarding it, he expressed his regret that he did not comprehend what I meant by the name. I then recollected that the name given it by Christians might not be understood by the Turks, and mentioned the name Agridagh, which just then occurred to my mind. The pasha was now quite at home, and appeared pleased to be able to inform me that he thought it not impossible I might succeed, for that his father had once attempted the ascent. When I now expressed a hope that, in case my arrangements should so require, I might be able to make my excursions from Bayazed, that is, from the southern side, he told me that he perfectly approved of my plan, and relieved my mind of all anxiety as to danger from the natives by offering me a letter to his family in Bayazed, which would secure me every assistance that I should need.

With respect to the selection of my headquarters upon the mountain, my intelligent and anxious friend, Aruthion Alamdarian, had spoken to me in Tiflis of a little Armenian monastery that he had heard of upon the northern slope of Ararat, higher up than the village of Arguri; but as he had never

been there himself, he could not positively say whether we should find it large enough for our accommodation. In this state of uncertainty as to the choice between a Christian monastery and a Mussulman city, I reached Echmiadzin. Here I expected to learn something positive to decide me, and I succeeded. The monastery of St. James, above Arguri, which had been mentioned by Alamdarian, did really exist,* and large enough for our purposes, as the monks declared; and besides, it had luckily been spared by the plague, which had spread to the village. There could *now* be no farther doubt as to which I should choose: we started in the direction of St. James's.

The way thither leads through Arguri, the distance being about a mile and a half, and so our little caravan halted under the outer walls of the monastery towards evening on the 11th of September. My first inquiry upon entering the courtyard was for the pastor: he stood before me, a venerable old man of tall stature, and a countenance expressive only of subdued passions, peace of mind, and dignified resignation. His head was gray, exempt from the obligation of tonsure since the downfall of the Persian sovereignty, and covered with the pointed capuchin cowl of blue Indian stuff; his beard was long; his eyes, deeply set and large, spoke only of chastened longings after a better world. This man, clad merely in a plain and worn gown of blue serge, with a pair of common slippers and woollen Persian socks—this was the Archimandrite of St. James's, Varthabed Karapet. In

* Yet we find allusion made in a recent work to the old doubts as to the existence of this place, which the traveller attempts to disprove by stating that it was pointed out to him from Diadina, on the south of Ararat, whereas it is situate on the northern side!—Vide Lettres sur la Perse et la Turquie d'Asie, par T. M. Tancoigne, 2 vols., Paris, 1819.

one hand he held his rosary; the other he laid across his breast as he returned my respectful salutation, replying to my application for the hospitality of the monastery with a hollow and weak voice, and in the Armenian language. After a preliminary survey of the shelter he had to afford us, we had our baggage unpacked and laid down, for the present, in the court, where it occupied a very respectable space. As soon as the peasants who had assisted us were dismissed, and before we proceeded to take up our quarters, I directed a skin of wine to be sought out—a reserve of genuine Kakhetian, and pledged the old man, with all hilarity, in a glass: this example was followed by the rest of the party, and repeated till every drop was gone, and the place of the red Caucasian wine left to be supplied by the golden juice of Father Noah's vines. Our respected host showed no reluctance to join us in this flow of feeling; but the gentleness and quietude of his bearing was unchanged, as well here as at every hour and under every phase of our subsequent intercourse. A mild benevolence was traced in the lines of his intelligent features, and an expression of paternal solicitude beamed from his animated eyes into my heart —a kindly intimation of the blessing which the Lord had determined to send upon this our sojourn.

CHAPTER VII.

Antiquity of the Name of Ararat.—Its supposed Origin.—Other Names, Massis, Agridagh.—Its Situation.—Great and Little Ararat.—Their Elevation.—Neighbouring Mountains.—Sublimity of Ararat not to be delineated.—Various Prints and Drawings of Ararat.—Mode of making exact Delineations.—Their Value.—The Author's Sketches of the Mountain described.—First Excursion up Ararat.—Illusion as to the Steepness of Mountains.—The Holy Well.—Its miraculous Virtues.—First Ascent of Ararat.—Great Height attained.—Fall in Descending.—Legend of St. James.—Attempt of the Pasha of Bayazed to ascend Ararat.—Its supposed Inaccessibility.—Not proved by Tournefort.

Ararat has borne this name for three thousand years. We read in the most ancient of all books, in the account of the creation left us by Moses, that "the ark rested, in the seventh month, on the seventeenth day of the month, upon the mountains of Ararat." In other passages of the Old Testament, written centuries afterward—in Isaiah, xxxvii., 38, and 2 Kings, xix., 37, mention is made of a land, in Jeremiah, li., 27, of a kingdom, of Ararat; and we are likewise informed by Moses of Chorene, the first authority among Armenian writers, that an entire country bore this name, after an ancient Armenian king, Arai, the Fair, who lived 1750 years before Christ. He fell in a bloody battle with the Babylonians, on a plain in Armenia, called after him Arai-Arat, the Fall of Arai.

Before this event, the country bore the name of Amasia, from its sovereign Amassis, the sixth in descent from Japhet, who gave the name of Massis to the mountain. This is still the only name by which it is known to the Armenians; for, although it is called Ararat in the Armenian edition of the Old Testament, yet the people (for whom the Bible

can be no authority, as they never read it) have retained the name Massis, and know no other; so that an Armenian, though from the holy mountain himself, if asked about Ararat, would appear as ignorant as a European interrogated respecting Massis, as if it were a well-known mountain.

We may reasonably conclude that Ararat is an appellation unknown to the Turks, and Persians also: the former call it, as I have already noticed, Agridagh—in Arabic, the Steep Mountain;* and as the Arabic is a sort of universal language in that quarter of the world, this name is equally familiar to the Kurds, Persians, and even Armenians themselves. The name by which it is known to the Persians is, according to some authorities,† Kuhi Nuh, the Mountain of Noah: upon this I cannot decide, as I have had but few opportunities of conversing with Persians, who, however, have always understood the name Agridagh.

The Mountain of Ararat rises on the southern borders of a plain, of about thirty-five miles in breadth, and of a length of which seventy miles may be taken in with the eye, being a portion of the plain which is watered by a wide curve formed by the Araxes. It consists, correctly speaking, of two mountains—the Great Ararat, and its immediate neighbour, the Less Ararat; the former on the northwest, the latter on the southeast; their summits distant about seven miles from each other in a right line,‡ and their bases insensibly melting into

* The author is here decidedly mistaken. Agridagh is not Arabic, but Turkish; in this language, *Dagh* means mountain: the first portion of the name admits of no certain explanation.—Ed.

† Manual of Biblical Antiquities, by Rosenmüller, i., 259 · and Chardin, Journal du Voyage, &c., London, 1686, p. 261.

‡ This is the result of M. Fedorov's geodesic measurement, and consequently to be relied on. It coincides, also, very nearly with the observations of Captain Monteith, of the Madras Engineers, who computes the distance between the two points at 12 000 yards, M. Fedorov making it 12,446 yards.

one another by the interposition of a wide level valley. This valley is now used as pasture-ground by the shepherds, but formerly it was taken advantage of by the Kurds as a convenient retreat, through which they might keep up an easy and certain communication between the provinces north and south.

The summit of the Great Ararat lies in 39° 42′ north latitude, and 61° 55′ east longitude from Ferro; it has an elevation of 17,210 feet perpendicular, or more than three miles and a quarter above the sea, and 14,320 feet, or nearly two miles and three quarters above the plain of the Araxes. The northeastern slope of the mountain may be assumed at fourteen, the northwestern at twenty miles in length. On the former, even from a great distance, the deep, gloomy chasm is discoverable, which many compare to a crater, but which has always struck me rather as a cleft, just as if the mountain had been rent asunder at the top. From the summit downward for nearly two thirds of a mile perpendicular, or nearly three miles in an oblique direction, it is covered with a crown of eternal snow and ice, the lower border of which is irregularly indented, according to the elevations or depressions of the ground, but upon the entire northern half of the mountain, from 14,000 feet above the sea, it shoots up in one rigid crest to the summit, interrupted here and there by a few pointed rocks, and then stretches downward, on the southern half, to a level somewhat less low. This is the silver head of Ararat!

Little Ararat is in 39° 39′ north latitude, and 62° 2′ longitude east from Ferro. Its summit rises 13,000 feet, or nearly two miles and a half, measured perpendicularly, above the level of the sea; and above the plain of the Araxes it is 10,140 feet,

or nearly two miles. Notwithstanding this height, it is not always buried in snow, but is quite free from it in September and October, and probably sometimes also in August, or even earlier. Its declivities are considerably steeper than those of the Great Ararat; its form is almost perfectly conical, marked with several delicate furrows, which radiate downward from the summit, and give the picture presented by this mountain a very peculiar and interesting character.*

Although these two mountains have no appearance of forming part of any range, but stand in independent grandeur by themselves, still they are not altogether unconnected with other hills. While the southwestern slope of both is lost in the hills of Bayazed and Diadina, which contain the sources of the Euphrates, the northwestern slope of the Great Ararat runs into a chain which borders the entire right bank of the Araxes, and to which many sharp, conical peaks give a very striking character. The west end of this chain wheels round the head waters of the Araxes, touches Erzerum, giving to the left side of this river, as it had already done to the right, an ornamental barrier of mountains, many of which, especially in the vicinity of Kars, must be of majestic height; for these must be the hills which I saw covered with snow to a considerable depth,

* It is incomprehensible to me how it could be asserted, in a recent work (Voyage Militaire dans l'Empire Othoman, par le Baron Felix de Beaujour, Paris, 1829, tom. ii.) that "le Mont Ararat, dont la tête, toujours couronnée de neiges, semble toucher aux cieux; à son double sommet *noirci par le feu* on reconnait que c'est une montagne volcanique;" as if it were necessary to direct the eye to the top of Ararat to find out that it is of volcanic origin; and as if a mountain, the head of which is covered with solid ice and snow, about half a mile in perpendicular depth, could at the same time have become black from the effects of fire! Would that the traveller could have arrived at the conviction that, in a portrait of the majesty and sublimity of Mount Ararat, it is not necessary to have recourse to fiction.

and for a length of twelve miles, in the month of October, at a time when nothing else but the summit of the Great Ararat retains it without melting. This I conceive to be the Saganlúg, a branch of Mount Taurus,* the witness of the heroic days of Kars, Assan-Kaléh, and Erzerum, as old Ararat was of those of Erivan and Bayazed.

The impression made by Ararat upon the mind of every one who has any sensibility for the stupendous works of the Creator is wonderful and overpowering, and many a traveller of genius and taste has employed both the powers of the pen and of the pencil in attempts to portray this impression. But the consciousness that no description, no representation, can reach the sublimity of the object thus attempted to be depicted, must prove to the candid mind that, whether we address the ear or eye, it is difficult to avoid the poetic in expression and the exaggerated in form, and confine ourselves strictly within the bounds of consistency and truth.

The earliest views of Ararat are found in Chardin,† in his seventh and ninth plates: the former, taken from Erivan, is a complete failure in every respect; the latter, from Echmiadzin, is not amiss in the outlines, and, in fact, is much better than many modern ones. Tournefort's‡ drawing is executed with spirit, and so far exact that almost every line in his hasty sketch is a delineation of nature, but with the most grotesque exaggerations, like his descriptions, in which he was carried away by a lively fancy. Morier§ made a drawing of both

* Voyage en Orient, par Fontanier, tom. i., Turquie d'Asie, Paris, 1829, p. 81.

† Journal du Voyage du Chev. Chardin. London, 1686; and the Parisian edition, by Langlés, 1811.

‡ Rélation d'un Voyage du Levant, Amsterdam, 1718, t. ii., p. 139.

§ Travels in Persia, Armenia, Asia Minor, &c., in the years

mountains from the eastern side, but is not true to nature in his representation of their forms, and seems rather to have been guided by the impression which his heated imagination received from the sight of these stupendous objects.* Besides, Little Ararat is, in his sketch, far too small—a mere rock in the shape of a thimble: there is too great a regularity in the outlines, which seems to have struck that traveller as an especial advantage that it had over other mountains; for he says, at p. 312 of his second work, "After we had crossed the plain from Abbesabad to Nakhjuwan, we had a most splendid view of Mount Ararat. Nothing can be more beautiful than its shape, more awful that its height. All the surrounding mountains sink into insignificance when compared to it. It is perfect in all its parts: no hard, rugged feature, no unnatural prominences; everything is in harmony, and all combines to render it one of the sublimest objects in nature."

That lively and intelligent observer, Porter,† has likewise far overstepped the bounds of nature, as far as regards the abruptness of the declivities, in his otherwise very beautiful delineation of the two Ararats: his making Little Ararat run up into a needle-shaped point is very incorrect.

M. von Kotzebue‡ has accompanied his amusing Journal with a small number of very interesting

1808 and 1809, by James Morier, Secretary of Embassy at the Court of Persia, London, 1813, p. 83, pl. 24; and A Second Journey through Persia, Armenia, &c., 1818.

* This is the drawing given in "Lettres sur le Caucase et la Georgie, suivies d'une Rélation d'un Voyage en Perse, en 1812." Hamburg, 1816, p. 237.

† Travels in Georgia, Persia, Armenia, &c., during the Years 1817, 1818, 1819, 1820, by Sir Robert Kerr Porter, London, 1822, vol. ii., p. 613.

‡ Travels into Persia, with the Russian Embassy, Weimar, 1819.

engravings in aquatinta, among which there is one of Ararat. The main features of both mountains are not to be mistaken; but the slopes of both, in consequence of an optical deception, which affects most free, off-hand sketches of isolated hills, are quite too steep, and Little Ararat is shown proportionably too high: the belt of clouds about the mountain is well done, and characteristic.

Sir W. Ouseley* has given some remarks on Ararat, and three views, in his valuable and copious work, which contains a circumstantial narrative of his travels in 1810, 1811, and 1812. Of these views, I must pronounce that taken from the plain of Erivan the best graphic representation of the mountain which we have yet had, although it is only two inches square, and contains scarcely anything in detail: both mountains are presented to the eye in perfectly correct contour, and of their exact relative size.

Besides these, a couple of copperplates have come under my notice, not as accompaniments of any book of travels, but independent prints of large size. One of them shows both Ararats, with the monastery of Echmiadzin, but is very inaccurate in the outlines, and quite erroneous in the details. This plate has a title, in Russian, but without date or author's name. A drawing, however, having a precise resemblance to this print, has fallen into my hands, under which there is written, with a pencil, "Vue du Monastère Etschmiadsin, et de la Montagne d'Ararat, en Arménie, prise du côté du Sud, dessinée, 1784, par P. d'Engelmann."

The two mountains are represented as tall and

* Travels in various Countries of the East, more particularly Persia, by Sir William Ouseley, Knt., Private Secretary to His Excellency Sir Gore Ousely, Bart., His Majesty's Ambassador Extraordinary and Plenipotentiary at the Court of Persia, London, 1823.

regular cones in another plate,* which includes also the monastery of Echmiadzin. This is a performance of little merit, either as regards fidelity or execution. To make amends, however, for this, we possess a very beautiful engraving of both Ararats,† lately published, with a foreground enlivened by an interesting group of Armenian colonists: it is of large size. The artist is M. Mashkov, a meritorious member of the Academy of Arts at St. Petersburg, from whose hand we have a large collection of the most interesting landscapes in Caucasus and the Trans-Caucasian provinces. He has delineated the present subject in an interesting manner, but has not removed the mountains sufficiently from the foreground; and, in consequence, the effect of their magnitude is very much impaired, while there is nothing gained by the disproportionate abruptness of the slopes, which is observable in this view as well as others.

As there is nothing so well calculated to convey a precise idea of the general impression produced by a mountain as a correct drawing, I have taken much pains to impart a character of perfect truth to the views presented to the public with this work. For this purpose, I have a long time made use of a very simple contrivance for taking outlines, which, though not new, is not employed by travellers, at least as often as it ought. It consists of a small frame of stiff pasteboard, about three inches long, and two and a half wide, divided on the inner edge into parallelograms by eight fine threads of dark silk, well varnished, so as both to fix the threads at the points where they cross, and to preserve them

* View of the Metropolitan Armenian Monastery (Russian) 1796.

† Transmigration de 40,000 Arméniens de Perse en Russie, sous les ordres du Colonel de Lazaref, en 1828. Cette vue est prise sur les lieux, par l'académicien Machkoff.

from damp. My portfolio is supplied with sheets of paper divided by pencilled lines into precisely similar figures, but of larger size; and these lines, as well as the threads of the frame, are marked with corresponding numbers—those running lengthwise with Roman, and those running crosswise with Arabic numerals—that no confusion may arise. After placing myself in the proper point of view, I hold the frame in such a manner before my eye that it may just include the part of the landscape I wish to take; or, if it is very long, I divide it into two parts. At this moment I fix my eye upon some two points of the prospect which can be readily found again, and which coincide with two points where the threads cross each other, so that the exact position may be regained in case the hand should move, or it should be necessary to interrupt the operation. When I catch the objects within the frame, I proceed to trace their outlines upon the ruled paper, thread by thread, as it is very easy to judge of a half, a third, or quarter distance by the eye. In this way I mark out, not only the external contours, but likewise individual objects within the extent of the landscape, such as buildings, trees, rocks, rivers, &c., in their actual situations and proportions. This can be done with as much accuracy by this plan as by the camera obscura or camera lucida: perhaps there may be a little more time lost in moving the eye constantly from the object to the paper and back again, but it certainly avoids the encumbrance of a special stand or table, the carriage of which is generally so troublesome and expensive, that it may explain why most travellers prefer depending on the correctness of the eye in sketching a landscape. Very accurate drawings have this peculiar advantage among others, that any changes which have taken

place upon a mountain in the lapse of time are readily discovered by them, such as the falling of rocks, the formation of clefts, changes in the boundary of snow, increase or decrease of the extent of forests, &c.

Whatever credit my views of Ararat should seem to deserve for fidelity and truth of perspective, besides correctness of proportion in the design, it must be awarded to M. Hagen, who, with the assistance of exact data as to the distances of the objects, has accomplished much more in his drawings and engravings than could have been expected from sketches so defective as mine. Thus, for instance, I flatter myself that the engraving of the monastery of Echmiadzin will be found to convey the impression of a wide monotonous plain, in which the buildings rise majestically, like an island in the sea; the little dependency of Gayanne lying near it, and in the background a faint perspective of both Ararats, the great mountain with its irregularly indented boundary of snow, and the great chasm. The point of view from which the monastery is supposed to be seen in this landscape is imaginary, for there is no rising ground in the neighbourhood from which the entire establishment could be overlooked, as it is here represented.

The aquatinta, as taken from Kanakir, the birthplace of my young friend Abovian, is no less successful. In this view, which is from a somewhat elevated situation, the ruins of the village appear in the foreground, as it was left in the Persian war; on the right, behind the skirts of a mountain, are the battlements of Erivan; in the distance, beyond the plain, a streak of mist, which settled above the Araxes as I took the sketch; and, lastly, the main feature of the whole, the Great Ararat, with its crown of snow and chasm of rock, and the Little,

with its distinctive belt of clouds; nowhere the appearance of a tree, but on the extreme right the acclivity of a low, spreading hill, composed only of fragments of lava.

The drawing made from Syrbaghan is, in my opinion, preferable to both the others, for the many and exact particulars with which it presents us regarding both the mountains. In the foreground is seen our party, with the road through this Tatar village, which lies between the Araxes and Ararat; at the side are flat roofs, on which the inhabitants often sit smoking, eating melons, and spinning; in the village are the only trees to be found in that tract of country: they are, the eleagnus, tall willows, some low bushes, and high herbaceous plants. Next a broad plain of ten miles across; and beyond that, the two splendid mountains, with their chasms, clefts, rents, and gullies, great and small, such as are only met with on an extinct volcano.

The view from St. James's is supposed to be taken at the entrance of the chasm, consequently on the mountain itself; in fact, from the burial-ground of the monastery: it exhibits, first, the lonely building, with its neat church, the adjoining cells, and the garden, all within a stone enclosure; outside of this are plantations of apricot-trees, small Italian poplars, lofty walnut-trees, and narrow-leaved willows; next, behind these, the ravine, traversed by the little torrent; and farther still, at the extremity of the chasm, the majestic icy peak itself, with every distinctive characteristic as it then was.

My anxious longing to approach nearer to the venerable head of the holy mountain would not allow me to remain long idle and irresolute in the quiet of the monastery. Anxiety as to the lateness of the season was beginning to produce its effect, when the serenity of the weather decided me



Ararat from Syrbaghan.

[*To face* p. 152.

at once to undertake an excursion to reconnoitre the summit the day after our arrival. When I speak of the serious difficulties with which I had to contend in the execution of my design, I may surprise many a one, who will be little disposed to admit that there could be any such abruptness in the declivities, or such unusual obstacles to the ascent, if the representation given of the mountain in my own drawings is to be taken as an authority. This is to be accounted for by a very common optical illusion, which every mountain traveller would do well to divest himself of, if he would avoid falling into some troublesome mistakes.

Whenever we ascend a mountain, and have the slope immediately before us, we think the angle of acclivity much greater than it would be found to be by the plummet. It is not unusual to find the estimate in this case double of the reality. The solution of this lies in the perspective shortening of the distances. The idea thus formed in our imagination of the steepness of the declivity is imbodied in the profile outline of the mountain, and hence the exaggerated forms of almost all rising grounds when sketched off-hand. Were they really so steep as they are shown in the drawings, there would not be very many of them climbed; for we must recollect that, though hills of an inclination of sixty degrees in drawings are not at all unusual, even among those classed with the accessible, still an acclivity of thirty-five or forty degrees is totally insurmountable, unless recourse be had to steps or ladders in the ascent, or the surface be composed of tolerably-sized angular stones, like stairs, not quite accidentally laid together.

On the 12th (24th) of September, at seven in the morning, I started on my way, attended by M. Schiemann. We took with us one of the Kossaks,

and a peasant from Arguri—a hunter, and directed our steps first to the ravine, and then along its left declivity, till we came to a spot where there were two small buildings of squared stone standing near each other, one of which was formerly a chapel, and the other erected over a well reputed holy. The Armenians assign to this chapel, which they have named after St. Gregory, a very remote origin, and make pilgrimages to it from distant quarters. During our stay we often encountered Armenians from Bayazed at the religious ceremonies which they are in the habit of performing there, after which the visiters amuse themselves with discharges of firearms, and other demonstrations of joy, in a remote part of the valley.

The fountain which springs out of a rock at this spot affords a clear, drinkable water, of a pure natural taste, and is therefore an object deserving of general estimation; for there cannot be many perennial springs upon Mount Ararat, as I have proved to my vexation, since in all my excursions upon it I never either found or heard of any other.

It is possible that it may have originally induced some devout monk to establish himself in that locality, whose reputed sanctity procured for the spring also the reputation of miraculous virtues, until, in the course of centuries and the storm of political events, the peaceful inhabitant was frightened away, and the miraculous spring alone remained as the object of universal veneration among the Armenians, wherever they may be scattered round the world.

The tradition respecting the wondrous virtue of the water is this, that the flights of locusts which occasionally traverse the country on this side, and beyond Caucasus, in countless numbers, and as a kind of field-plague, often laying waste an entire

province in a single day, cannot be expelled otherwise than by means of a certain bird, which I have never been able to see, but infer, from the description given of it, to be a kind of thrush, though the Russians settled in this country call it a starling. Not very large, it is dark-coloured, yellowish-white on the breast and back, and is said to resort in flocks to the Araxes when the mulberries are ripe—though why they do so is not well explained—and to do much damage by destroying the mulberries. Its Armenian name is Tarm; it is also called Tetägush (*gush*, in the Tatar language, means *bird*, and *tut* is the Armenian for *mulberry*); the Tatars call it Gasyrtshakh. Should it make its appearance in a tract infested by the locusts, then the fields are soon saved, for it pursues the locusts with implacable enmity. With the view of enticing this serviceable bird, the water of the holy well is brought into requisition, and for this purpose it is sufficient just to fill a pitcher or a bottle with it, and to set it down in the neighbourhood of the locusts, taking care, however, not to let the vessel touch the ground anywhere on the way, for in that case the water immediately disappears; but if set in the open air and in the proper place, it never fails to attract to the spot a flock of the tetägush, which soon rid the district of the devouring plague. Not merely the common people and Armenians, but some even of the educated classes, and not of the Armenian creed, have sought to convince me of the truth of this story, and related as a proof that, a few years before, the country round Kislyar, on the northern side of Caucasus, being attacked by locusts, was saved through the virtue of a bottle of water fetched in the greatest haste from the holy well, and which immediately brought together a flock of the birds. At

Ararat and in Tiflis every one knew that the water was brought, and as to the success attending the use of it, that might be easily learned in Kislyar, where the bottle, with some of the miraculous water, was still lying in the church!

From this chapel we ascended the grassy eminence which forms the right side of the chasm, and had to suffer much from the heat, insomuch that our Kossak, who would much rather have galloped for three days together through the steppe, seated on horseback, than climb over the rocks for two hours, declared that he was ready to sink with fatigue, and it was necessary to send him back. About six o'clock in the evening, as we, too, were completely tired, and had approached close to the region of snow, we sought out a place for our night's lodging among the fragments of rock. We had attained a height of 12,360 feet; our bed was the hard rock, and the cold, icy head of the mountain our only stove. In the sheltered places around still lay some fresh snow; the temperature of the air was at the freezing point. M. Schiemann and myself had prepared ourselves tolerably well for this contingency, and our joy at the enterprise also helped to warm us, but our athletic yäger Sahák (Isaac), from Arguri, was quite dispirited with the cold, for he had nothing but his summer clothing; his neck and legs from the knee to the sandal were quite naked, and the only covering for his head was an old cloth tied round it. I had neglected, at first starting, to give attention to his wardrobe; it was, therefore, my duty to help him as far as I could, and as we had ourselves no spare clothing, I wrapped his nakedness in some sheets of gray paper which I had brought with me for the purpose of drying plants: this answered him very well.

As soon as the darkness of night began to give

way to the dawn, we continued our journey towards the eastern side of the mountain, and soon found ourselves on a slope which continues all the way down from the very summit. It may be seen in the drawing of the Convent of St. James, on the left, behind the roundish and grassy projecting hills; it is formed altogether of sharp, angular ridges of rocks, stretching downward, and having considerable chasms between them, in which the icy covering of the summit disappears, while forming glaciers of great extent. Several of these rocky ridges and chasms filled with ice lay between us and the side of the mountain which we were striving to reach: we got successfully over the first ridge, as well as the beautiful glacier immediately succeeding it. When we arrived on the top of the second ridge, Sahák too lost the courage to proceed farther: his limbs, frozen the preceding night, had not yet recovered their natural glow, and the icy region towards which he saw us rushing in breathless haste seemed to him to hold out little hope of warmth and comfort; so, of our attendants, the one was obliged to stay behind from the heat, the other from the frost. M. Schiemann alone, though quite uninitiated in hardships of this kind, yet never lost the heart and spirit to stay at my side; but, with youthful vigour and manly endurance, he shared in all the fatigues and dangers, which soon accumulated to an extraordinary extent. Before the eyes of the tarrying yäger, we crossed over the second glacier which lay before us, and ascended the third ridge; taking an oblique direction upward, we reached, at the back of it, and at an elevation of 13,954 feet, the lower edge of the ice, which continues without interruption from this point to the summit.

Now, then, the business was to mount thi

steep, covered with eternal winter. To do so in a direct line was a thing impossible for two human beings, although the inclination did not quite amount to thirty degrees. We therefore determined to go obliquely upward on the slope till we gained a long, craggy ridge, which stretches a great way up towards the summit, and slight indications of which may be seen on the left side of the mountain, in the sketch made from St. James's, as well as in that from Syrbaghan. This we succeeded in accomplishing, by cutting with our staffs regular hollows in the ice, on which lay a thin coat of newly-fallen snow, too weak to give our footsteps the requisite firmness. In this way we at last got upon the ridge, and went along it, favoured by a deeper drift of the fresh snow, directly towards the summit.

Although it might have cost us great exertions, yet it is probable that on this occasion we could have reached, contrary to all expectations, the lofty aim of our wishes; but our day's labour had been severe; and as it was three o'clock in the afternoon, it was time for us to consider where we should find a resting-place for the coming night. We had reached nearly the farthest end of the rocky ridge, and an elevation of 15,400 feet above the sea, or about the elevation of the summit of Mont Blanc, and yet the head of Ararat, distinctly marked out, rose to a considerable height above us. I do not believe that there existed any insuperable obstacle to our farther advance upward; but the few hours of daylight which still remained to us for climbing to the summit would have been more than expended in accomplishing this object, and there, on the top, we should not have found a rock to shelter us during the night, to say nothing of our scanty supply of food, which had not been calculated for so protracted an excursion.

Satisfied with the result, and with having ascertained that the mountain was by no means wholly inaccessible on this side, and having made our barometrical observations, we turned about, and immediately fell into a danger which we never dreamed of in ascending; for, while the footing is generally less sure in descending a mountain than in ascending it, at the same time it is extremely difficult to restrain one's self and to tread with the requisite caution when looking from above upon such a uniform surface of ice and snow as spread from beneath our feet to the distance of two thirds of a mile without interruption, and on which, if we happened to slip and fall, there was nothing to prevent our rapidly shooting downward, except the angular fragments of rock which bounded the region of ice. The danger here lies more in want of habit than in real difficulty. The active spirit of my young friend, now engaged in his first mountain journey, and whose strength and courage were well able to cope with harder trials, was yet unable to withstand this: treading incautiously, he fell; but, as he was about twenty paces behind me, I had time to strike my staff before me in the ice as deep as it would go, to plant my foot firmly on my excellent many-pointed ice-shoe, and, while my right hand grasped the staff, to catch M. Schiemann with my left as he was sliding by. My position was good, and resisted the impetus of his fall; but the tie of the ice-shoe, although so strong that it appeared to be of a piece with the sole, gave way with the strain; the straps were cut through as if with a knife, and, unable to support the double weight on the bare sole, I also fell. M. Schiemann, rolling against two stones, came to a stoppage, with little injury, sooner than myself; the distance over which I was hurried almost un-

consciously was little short of a quarter of a mile, and ended in the debris of lava not far from the border of the glacier.

In this disaster the tube of my barometer was broken to pieces, my chronometer was opened and sprinkled with my blood, the other things which I had in my pockets were flung out by the centrifugal motion as I rolled down, but I was not myself seriously hurt. As soon as we had recovered from our first fright and had thanked God for our preservation, we looked about for the most important of our scattered articles, and then resumed our journey down. We crossed a small glacier by cutting steps in it, and soon after, from the top of the ridge beyond it, we heard with joy the voice of our worthy Sahák, who had had the sagacity to look for and await our return in this spot. In his company we had at least the satisfaction of passing the night in the region of grass, to the dry heaps of which, being always chilly, he set fire, in order to warm himself. On the third day, about ten o'clock in the morning, we reached our dear monastery, where we refreshed ourselves with juicy peaches and a good breakfast, but took special care not to let a syllable escape us, while among the Armenians, respecting our unlucky falls, as they would not have failed to discover therein the divine punishment of our rash attempt to arrive at the summit, access to which, from the time of Noah, has been forbidden to mortals by a divine decree; for all the Armenians are firmly persuaded that Noah's ark remains to this very day on the top of Ararat, and that, in order to ensure its preservation, no human being is allowed to approach it.

The chief authority for the latter tenet is afforded by the Armenian chronicles, in the interesting legend of the monk named Jacob, who was after-

ward patriarch of Nisibis, and is supposed to have been a contemporary and relative of Saint Gregory. This monk, in order to put an end to the disputes respecting the credibility of the Holy Scriptures—that is to say, as far as the history of Noah is concerned, resolved to convince himself, by personal inspection, of the actual existence of the ark on the summit of Ararat. On the side of the mountain, however, he fell asleep several times through fatigue, and always found, on awaking, that he had, during his slumbers, unconsciously gone down as much as he had been able to ascend with his waking efforts. At length God, taking compassion on his unwearied but fruitless efforts, sent an angel to him in his sleep to tell him that his labours were in vain, for the summit was unattainable; yet, to reward his zealous efforts, and to satisfy the curiosity of mankind, he sent him a piece of Noah's vessel, as it lay on the mountain—the same piece which is preserved as a peculiarly holy relic in the Cathedral of Echmiadzin. This story, sanctioned by the Church, converts the popular assumption of the Armenians respecting the impossibility of ascending Ararat into an article of faith, to which they cling the more affectionately, inasmuch as it relieves them of a great labour; and an Armenian will not abjure this erroneous belief, even after he shall have been placed on the top of Ararat, of which more hereafter.

A pasha of Bayazed, the father and predecessor of the present Mohammed Bähälühl, who cannot be supposed to have been influenced by the religious prejudices of the Armenians, contributed, by his failure in an attempt to ascend Ararat, to confirm the belief in the impossibility of such an achievement. The pasha set in earnest about the attainment of his object, and he also offered a re-

ward to any one who would carry his plan into execution; yet he ascended no higher than within about 2400 feet of the limits of the ice, or as far as one can go on an active Persian horse. As to the reward offered by the Persian ruler, it does not appear to have ever tempted any of his dependants; and, in truth, the Persian, habituated to warmth and comfort, is not the man to achieve a feat of this kind.

The learned world, too, is not without an authority to prove the impossibility of ascending Ararat. I do not allude to the numerous travellers who, either from want of time, of curiosity, or of means, or deterred by the common opinion of the people, have never made any attempt to reach the summit, and, filled with amazement at the truly impressive aspect of the mountain, have felt disposed to enhance still farther the sentiment of grandeur by the idea of utter inaccessibility, but I speak of Tournefort, to whom Morier particularly refers in his second journey, where he says, "No one appears to have reached the summit of Ararat since the flood; and the steep sides of its snowy head appear to me, moreover, sufficient to frustrate all attempts of that kind. When even Tournefort, that persevering and courageous traveller, could not succeed in it, how could we expect the timid and superstitious inhabitant of these countries to be more fortunate."* But it is only necessary to read

* It ought to be observed, that although Morier speaks emphatically of the supposed impossibility of ascending Ararat, yet he did not quite despair of succeeding in the attempt himself. He says (Second Journey, p. 344), "During the long time that we were in the neighbourhood of Mount Ararat, although we made frequent preparations for attempting to ascend it, yet we were always impeded by some reason or other. We were encamped before it at the very best season for such an undertaking, namely, during the month of August, and saw it at the time that it has least snow upon it."—Ed.

what Tournefort says of his expedition to Mount Ararat, and his description of his attempt to ascend it, in order to be convinced that he cared less about reaching the summit of the mountain than "to acquire," as he himself naïvely expresses it, "the reputation of a martyr of botany." "We assured our guides," he says, "that we would not go beyond a patch of snow which we pointed out to them, and which seemed no bigger than a cake; but when we came to it, we found that there was more of it than would suffice to satisfy our appetites, for the patch in question was above thirty paces in diameter. Each ate as much or as little of it as he pleased, and, by common consent, it was resolved to go no farther. We then descended with admirable vigour, delighted at having accomplished our vow, and at having nothing more to do but to return to the convent."* Whoever reads throughout the account of the expedition, with its comic descriptions and exemption from everything like seriousness—as, for example, "we allowed ourselves to slide on our backs for more than an hour on this green carpet; we got on very agreeably, and travelled faster this way than if we had thought fit to make the most of our legs; we continued, then, to slide along while the ground permitted it, and when we met with stones which bruised our shoulders, we slided on the belly, or we marched backward on all fours"—cannot fail to perceive that Tournefort had no ambition whatever to be enumerated among those who strenuously and perseveringly attempted to reach the summit of Ararat; and, in truth, he was quite free from the enthusiasm in favour of the locality which inspires travellers of later times, not one of whom would be found willing to subscribe to these words

* Relation d un Voyage du Levant, Amst., 1718, tom. ii., p. 149.

of Tournefort: "This mountain, which lies between the south and south-southeast of the Three Churches, is one of the most dismal and disagreeable sights on the face of the earth."

CHAPTER VIII.

Second Attempt to ascend Ararat.—The Cross consecrated.—The Expedition starts.—Stepan Melik.—The Route described.—Tournefort's Remarks.—Stony Zone.—Path practicable on Horseback.— Kip-Ghioll.— Hidden Glaciers.— Night on the Mountain.—Perpetual Ice.—The Cross erected.—Its Inscription.—Height of the Place.—Descent.—Monastery of St. James.—Armenian Bread.—Its various Uses.—Kossak Ingenuity.—Fuel.—Magnetic Experiments.—Excursion to Kulpe.

On the day after my return I had a smart attack of fever, probably the consequence of the violent agitation of mind and body which I had experienced during the descent, and I felt it necessary to submit to a course of medical treatment. I looked upon it as an intermittent fever, yet abstained from the use of quinine, of which I had a whole ounce in my little medicine chest, but prescribed to myself a strict diet—no meat, no fruit, no milk—merely plain tea, and, by way of medicine, garlic, which I had tried successfully on a previous occasion, eaten with salt and a little bread. The fever returned no more; I was recovered, and so I now applied myself to the cure of my barometer, which, with the aid of the reserved tubes, the thermometer, and the store of quicksilver, was soon completed. In short, I made every preparation for the real attempt to reach the summit: I hired attendants and beasts of burden, provided food, and got ready the inscription on a strong leaden plate, which I intended to take with me, and to fasten on a cross to be erected on the highest point.

This cross had been made in Echmiadzin, of fir; was ten feet long, and for its other dimensions about six inches square; it was painted black, and easily taken asunder. On the morning of the 18th of September we were all ready to start. I put the cross together; it was then placed in the court of the convent, and, with all solemnity, according to the Armenian ritual, it was consecrated by the venerable archimandrite with prayer and anointing. It was then again taken asunder and fastened on the beasts of burden; and I had occasion to remark, that the Armenians engaged at this work were careful not to brush off the cotton adhering to the wood in three or four places, and saturated with the holy oil. About half past eight o'clock the train was in movement. It consisted of myself, M. von Behaghel, M. Schiemann, the Deacon Abovian, four Armenian peasants from Arguri, three Russian soldiers of the 41st Yäger regiment, and a driver for the four oxen.

A chief person in the expedition was the village elder already mentioned, Stepan Melik of Arguri, who had himself asked permission to join it, and who, as it soon became evident, was eminently fitted to guide its steps. I readily followed the advice of this experienced man to try the ascent of the summit this time from the northwest side of the mountain, where the way, though considerably longer than on the eastern declivity, is in general much less precipitous. After we had gone two thirds of a mile on the left slope of the valley, we ascended, and went straight across the northern side in a westerly direction, without meeting with much difficulty, as the ground presented few inequalities, and there were paths fit for use which led over them. At first we found the ground covered with withered grass, and but few plants with ver-

dure undecayed. We then came into a tract covered with volcanic sand and a pumice-like shingle, probably that of which Tournefort (p. 149), somewhat hyperbolically, says, "It must be allowed that the eyes are much deceived in measuring a mountain from the base to the summit, and particularly when one has to pass over sands as annoying as the African deserts. What an amusement for people with nothing but water in their stomachs to sink up to the ankle in sand!"

While we kept advancing continually in an eastern direction over this, in my opinion, not very difficult tract, and at the same time gradually got higher, we came suddenly on the stony region, which forms a broad zone round the mountain immediately below the limits of the perpetual snow, and consists wholly of angular fragments of dark-coloured volcanic rock, which, scattered in wild disorder, sometimes present the appearance of a rude wall, sometimes that of a craggy ridge, and are at times heaped together in a narrow chasm or the valley of a glacier. Here we found at our service a little path, beaten probably by the small herds of cattle which in the summer, when the herbage fails below, are obliged to seek their food on the remotest elevated parts of the mountain. This path led to a considerable plain, nearly horizontal, and well covered with grass, which, like a carpeted step, interrupts the stony tract on the northwest side of the mountain. M. von Behaghel, M. Schiemann, and myself had each of us brought a saddle-horse from the monastery, and at first we made use of them; but on arriving at the precipitous stony tract, which we reached about eleven o'clock, we perceived the necessity of sending them back with the Kossaks who accompanied us for this purpose, as they did not seem capable of enduring the hard-

ship of travelling over such rough ground; yet I saw with astonishment the little Persian pony of Stepan carry its tall master with unwearied strength and activity over the most difficult and dangerous places, and climb, without a slip, incredibly steep acclivities.

The plain which we had reached is called, in Tatar, Kip-Ghioll, that is, Kip-spring, in consequence of a canal or drain projected here by the Persian government, the object of which was to collect the snow-water of Ararat, and conduct it to a rivulet, near which stood at that time, on the road to Bayazed, the village Gorgan, which is now deserted and fallen to ruins, in consequence of the gradual drying up—from what cause is not known—of the water of this rivulet. It did us all good to be able to rest a little, after an uninterrupted ascent of five hours, on a spot which reminded us of animated nature. While our cattle found a hearty meal in the half-green herbage, we recruited our strength with a simple but invigorating repast, to which we were enabled to add soup, since the tract around us, being resorted to in summer for pasture, was thickly strewed with dry dung, which made excellent fuel. Directly over this plain, which has an elevation of 11,500 feet above the sea, the slope of Ararat rises very steeply, yet the ascent is here easy, the ground being sprinkled with soil, and not without herbage; but, on mounting a little higher, the desolate stony region recommences, not again to disappear till at the margin of the perpetual ice.

In this way we arrived, not far from Kip-Ghioll, at a glacier of considerable extent, but which will soon be concealed from the eyes of the traveller if the mountain continues to cover it, as at present, with lava, sand, and fragments of rock, for even

now the ice can be seen only at the deep cracks, and involuntarily reminds us of the remarkable iceberg, covered with luxurious grassy vegetation, which Eschholz discovered in Kotzebue Sound, within Behring's Straits.* This glacier did not appear to me to be a continuation of the icy head of Ararat, but to stand by itself, unless its connexion with the ice above be concealed under a very thick layer of stones; on which point, having been obliged to content myself with a distant inspection, I am not prepared to offer any conjecture. The lowest commencement of an extended snowbank, immediately derived from the snowy region of Ararat, I found at an elevation of 12,540 feet above the sea.

About six o'clock in the evening, as we had reached a height of 13,070 feet, and were at no great distance from the borders of the snow, I felt myself compelled to determine on fixing our night's quarters among some large and conveniently-placed masses of rock, since, as difficulties were increasing around us, it would hardly be possible to carry our slender supply of firewood higher up. The strong and patient oxen had carried their burdens up to this spot with incredible exertion, and many a crossing back and forward had they to make on the face of the acclivity, in order to follow us. Even Melik's horse had overcome all the obstacles presented by the rugged nature of the ground, and had borne his master to this great elevation. It was now the common lot of these poor animals, when freed from their loads, to be turned loose in a desert, where there was nothing to satisfy their hunger but the few herbs scattered over these heights, and to quench their thirst nothing but the hard snow

* Voyage of Discovery in the South Sea and Behring's Straits, by Otto von Kotzebue, 1821, vol. i., p. 146.

of the neighbouring glacier: in truth, I pitied them. A little fire was made, but the air was cool, and the ground not warm.

Sleep refused to visit me on this occasion, and in my heart I felt more of anxiety than of hope for the attainment of our object. I know not what it was that filled me with this gloomy presentiment; perhaps it was but the language of bodily indisposition; for the injuries, superficial as they were, which I had received on the 13th, were not yet quite cured, and a violent contusion on the left hip, received on that occasion, had pained me the whole way up: the fever might have somewhat weakened me; and, in short, although in the course of the day's journey I was never last, and caused no delay, yet I felt that I wanted the strength and spirit which were required, in order that, on the following day, in ascending the difficult icy region, I might be able to expedite, as I had always been used to do, the attainment of our object, by taking the greatest share of the labour on myself.

In the mean time, the night passed over, and at half past seven in the morning we resumed our march, the thermometer being four degrees below the freezing point. In about two hours we had reached the limits, properly so called, of the perpetual ice and snow, that is to say, not the place where the snow, favoured by the coolness of a valley or other circumstances, remains at the lowest elevation, but where, extending continuously on a uniform slope, it is checked only by the warmth of the region below it. I found those limits to be at the height of 14,240 feet above the level of the sea. The way up to that point from our night quarters was rendered extremely fatiguing by the steepness of some of the rocky tracts, which were passable only, because, consisting of masses of rock

piled one upon the other, they offered angles and edges for the hands and feet; but on that very account they threw impediments in the way of carrying up the great cross: in vain we tried to let two men bear the long beam; for on ground where the choice of each step was confined to some particular spot, every movement of the one carrier embarrassed and endangered the other; and besides, the beam, being ten feet long, was every moment knocking against something in the sharp turnings of our crooked path. Such, however, was the devout zeal of one of the Armenian peasants, that, at the moment when the necessity of leaving the cross behind us seemed inevitable, he heaved the long beam on his shoulders, drew the end of his frock from behind over it, holding this down with both hands, in such a way, too, as to save the cotton with the holy oil; and now, like an athlete, with astonishing dexterity he bore his load over the tortuous and rugged path.

For an instant we halted at the foot of the pyramid of snow, which before our eyes was projected with wondrous grandeur on the clear blue sky: we chose out such matters as could be dispensed with, and left them behind a rock; then serious and in silence, and not without a devout shuddering, we set foot upon that region which certainly, since Noah's time, no human being had ever trodden. At first the progress was easy, because the acclivity was not very steep, and besides, it was covered with a layer of fresh snow, on which it was easy to walk; the few cracks in the ice, also, which occurred, were of no great breadth, and could be easily stepped over. But this joy did not last long; for, after we had advanced about 200 paces, the steepness increased to such a degree that we were no longer able to tread securely on

the snow, but, in order to save ourselves from sliding down on the ice beneath it, we were obliged to have recourse to that measure, for the employment of which I had taken care to equip myself and my companions, namely, the cutting of steps. Although that which is called ice on such mountains is in reality snow converted into a glacier, that is to say, permeated with water and again frozen, in which state it is far from possessing the solidity of true ice, yet, like this, it does not yield to the pressure of the foot, and requires, where the slope is very rapid, the cutting of steps. For this purpose some of us had brought little axes, some billhooks, while others, again, made use of the ice-staff. The general rule in the ascent was, that the leader should only cut the ice just enough to allow himself to mount, and that each as he followed should enlarge the step; and thus, while the labour of the foremost was lightened, a good path was prepared for the descent, wherein much firmer footing is required than in ascending.

Through this proceeding, dictated off-hand by necessity and frequent experience, and which, moreover, could not be dispensed with for a single step, as well as through manifold hinderances of a new sort which obstructed the carrying up of the cross, our progress suffered so much delay, that, though in the stony region, which was by no means easily traversed, we had been able to gain about 1000 feet of elevation in the hour, we could now hardly ascend 600 feet in the same time. It was necessary for us to turn a bold projection of the slope above us, and, having come to it, we found on it, and straight across the direction in which we were proceeding, a deep crack in the ice, about five feet wide, and of such length that we could not distinctly see whether it was possible to go

round it. To our consolation, however, the drifted snow had in one place filled up the crevice tolerably well, so that with mutual assistance we got safely over, a feat rendered somewhat difficult by the circumstance that the edge of the ice which we wanted to reach was a good deal higher than that on which we were standing.

As soon as we had got over this little trouble, and had ascended a very moderate slope, we found ourselves on a nearly horizontal plain of snow, which forms a principal step on this side of Ararat, and may be easily recognised in all my sketches of the mountain as an almost horizontal interruption of the slope, next to the summit on the right-hand side. This height was the scope of our exertions this time; for we had, to judge from appearances, work for three hours, and there arose, to our sorrow, a strong, humid wind, which, as it gave us reason to expect a snowstorm, damped our courage, and took from us all hope of reaching the summit. I made up my mind to erect the cross that we had brought with us on this height, and for that purpose sought out a spot visible from the monastery, or at least from Erivan, and such we found on going little more than half a mile towards the east, without ascending much. While some of us were employed in cutting a hole about two feet deep in the ice with bills and poles, others joined together the timbers of the cross with two strong screws, and over the joint, fastened in like manner with screws, the leaden plate, weighing twenty-seven pounds. The cross was then raised up, every one lending a hand to the work, and with pieces of ice and snow was fixed firmly in the hole. It faces Erivan, and has behind it in that direction the steep snows of the summit, so that, being itself black, it will be strongly relieved.

and must be visible with a good telescope. On the leaden plate is the following inscription:

NICOLAO PAULI FILIO
TOTIUS RUTHENIÆ AUTOCRATORE
JUBENTE
HOC ASYLUM SACROSANCTUM
ARMATA MANU VINDICAVIT
FIDEI CHRISTIANÆ
JOANNES FREDERICI FILIUS
PASKEWITSCH AB ERIVAN
ANNO DOMINI MDCCCXXVI.

I now suspended my barometer from the cross in order to determine our elevation above the sea, which I found to be 16,028 feet (our levelling to the shore of the Black Sea being included in the calculation), or about 350 feet more than the summit of Mont Blanc. Impelled by a common feeling, we turned once more towards the summit, and I could not refrain from asking myself whether in reality we should now resign the hope of reaching it. But the watch, which told us that it was midday; the sky, where clouds were gathering; and our inadequate means for spending a night on the icy pinnacle, all plainly said "no" to the thought of advancing; and the declaration of the sturdy guide, Stepan Melik, "Time alone is wanting; for the rest, we are nearly on the top," completely soothed the downcast spirits of all but myself, whose only consolation was the hope of another and more successful attempt.

The steps by which we had mounted aided us also in our descent, and without any accident beyond a transient giddiness which attacked M. von Behaghel, we reached, before night had fully set in, the place where we had rested at noon on the way up, the Kip-Ghioll, a charming spot to the

weary, where we also found Melik's horse, the oxen, and the drivers, for they had sagaciously determined on descending from the inhospitable rocks and glaciers, among which we had left them, and rather to wait for us here. We also were glad to warm ourselves at a brisk fire, for we had hardly left the snowy region in our descent when the whole tract over which we passed nearly down to Kip-Ghioll was visited by a heavy fall of moist snow, which disappeared the next day. Having taken our evening repast, we each of us sought, under the large rocks scattered in great numbers over this plain, shelter and lodging for the night, and the following day, the 20th of September, about ten in the morning, we reached St. James's.

I have not yet made the reader acquainted with our domestic arrangements and mode of life in the monastery, which nevertheless, though extremely simple, may be not uninteresting to future travellers. Close to the right bank of the Arguri rivulet, about twenty-five feet above the stream, between the rocky and grassy slopes in the lower part of the great chasm, which even here has still a depth of from 600 to 800 feet, lies the little monastery of St. James, at an elevation of 6350 feet above the sea. It consists of a little church built in the form of a cross, with a cupola like a truncated cone in the middle, and entirely constructed, even to the very roof, with hewn stone of hard lava. But the principal entrance is so hidden by the dwellings built against the church, that even in broad daylight it is difficult to work one's way, without knocking against some corner, through the narrow and crooked passage leading from the northern side and across a dark portico to the door on the western side of the temple. Abutting on the church on the eastern side is a long chamber pro

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vided with a fireplace, which we at first used as our common bed and sitting room, but afterward made it our kitchen, for a much larger room was soon found for the former purposes, drier also, and having two openings for the admission of light. It adjoined the cell of the archimandrite, who, after he had become a little acquainted with us, made no difficulty about removing a few corn-sacks lying there, and leaving the place wholly at our disposal.

Our furniture consisted of the blankets, pelisses, cloaks, and chests brought with us. Our dinner-table was a singular piece of basket-work, of split wood interwoven, not quite so high as an ordinary stool: it was too tottering for a work-table, so we preferred writing on the knee, or lying on our baggage, or, in case of nice work, on one of the stands of our instruments. Whoever did not like to eat standing, might seat himself on a big stone which lay there at his service. All these dwellings round the church are made with thick clay walls, and are covered in common with a perfectly flat roof of strong plaster, under which, in the middle of each apartment, is a prop; the wooden support of the ceiling in our room answered well for the hooks whereon we hung our clothes. This room was too narrow and too dark for the numerous and important instruments which we had with us: they were more suitably placed in a pretty tent of sailcloth and white woollen, which was pitched in the middle of the court, where the instruments were arranged according to their respective uses, and where I, for the purpose of watching them, had established my night quarters. A great projecting corner stone of a partition wall in the court, and close to the tent, appeared to M. Fedorov to be a good basis for the observations with the theodolite;

and, to make it more convenient, he dug a little trench round it, in which he stood. With the permission of the archimandrite, a little corner of the wall, which confined the field of view, was removed, and the arrangement of the observatory was thereby completed.

To provide for our subsistence and necessities was not the least of our cares. We *savans* were five in number; there was one young priest, one feldyäger, six Kossaks, and four soldiers, in all seventeen men; and we had with us eleven horses, of which five were our own. We had brought with us two Kossaks from Tiflis, and four others were assigned to us in Erivan on the order of the military chief, who also allowed us the four privates of the 41st Yäger regiment. In order to look after provisions and to make some purchases, I had already despatched the feldyäger, M. Schutz, from Echmiadzin to Erivan, with the necessary papers and money, and while I was engaged in my first expedition on the mountain, he, having completely executed his commissions, arrived at St. James's. One of the soldiers was an experienced cook, and in that way rendered us essential service during the whole time of our stay at Ararat. Another, somewhat advanced in years, was well adapted for the office of general superintendent of the party, and for distributing the rations; he it was who formally reported to me, morning and evening, according to military usage, whatever had occurred. The fodder for the horses consisted partly of barley—for oats are never cultivated in this country, but the horse feeds well and without any detriment on simple unprepared barley—and partly of hay, the procuring of which gave us some trouble, because at this time of the year, and particularly after a dry summer, it is sure to be scarce.

Our own subsistence was provided for in the following manner: there was no want of mutton, for a sheep might be bought in Arguri whenever it was necessary. We also received two sheep as presents, one on the day of our arrival, by way of welcome, from our worthy archimandrite, another. somewhat later, from Stepan Melik; but far better flavoured and more nutritive was the flesh of wild hogs, subsequently shot by our Kossaks among the reeds on the Blackwater, and a large portion of which was then salted, a great crock which happened to be in the monastery serving us for that purpose. M. Schiemann did not fail also to supply our table, whenever an opportunity was offered, with game, and dried fish was brought to us for purchase, particularly an extremely well-flavoured kind of salmon-trout from the Gokchai. Eggs, milk, and pullets were to be had in Arguri; but as, at first, I laid a strict interdict on that place, because the plague had been raging there, and a few persons were still to be found in it only just recovered, these dealings were all carried on with great caution: the people who came from the village were not allowed to stay in St. James's longer than was necessary; the purchased sheep were sprinkled over with chloride of lime, as well as the woollen sacks in which the barley for the horses was brought to us from places in the neighbourhood.

The archimandrite obligingly supplied us with some cream, for which we daily provided him with tea and wine. We got from Erivan our stock of groats, lentils, dried apricots, kishmish, or raisins without stones, rice, onions, salt, pepper, sugar, tea, and rum; the last two, however, at a high price, the sugar costing two or three rubles a pound. There was a little luxury, also, which I allowed

only to myself, namely, a cup of strong coffee after dinner, when I was at home. Now and then we had a basketful of grapes and other fruit; the goatskin bottle gave us wine of Erivan, so that we wanted nothing but pure, good drinking water in the immediate vicinity of the monastery, for the water of the Arguri brook was always muddy, and consequently fit only for the cattle and for cooking; it was quite useless for washing, it contained such a quantity of earthy particles, and our people were therefore obliged, when the washing took place, to go down about half a mile towards Arguri, to a place where numerous fine springs issued from the rocks, from which we had brought to us also our daily supply for drinking.

At first we were ill off for the most important article of daily subsistence—bread. The Armenians make use of a kind of bread which, whatever may be its good qualities in other respects, wants the flavour and the strength requisite for the European palate and stomach. The *losh*, as they call it, is a thin cake an ell long, half an ell wide, and about as thick as the blade of a knife, rolled out of weakly-fermented dough; being spread on a leathern cushion, it is pressed against the inside of the heated oven, to which it adheres; in two or three minutes it is baked through, and here and there burned a little; it is then torn off to make way for another. The oven used for baking this bread is of a peculiar kind: a pit in the chamber or porch of the dwelling, wide at the bottom, narrow above, well coated with fine plaster, and heated with wood; such is the oven, which has, at least, this advantage, that it takes up no room, being covered over when not in use.

This losh is the bread universally used among the Armenians, and it serves for many purposes

which elsewhere no one would expect from bread; for example, at meals the table is covered with it, and every one partaking has a whole losh set before him as a napkin, with which, preparatory to his eating it, he can wipe his mouth. When sour milk is part of the feast, a piece of losh is broken off, and folded up so as to make a spoon; it is then dipped into the bowl, and so milk and losh are swallowed together. Raw and preserved roots, and stalks of edible plants, which are always to be found on the tables of the Armenians, are wrapped up in a piece of losh, a bit of fish and meat added thereto, and the whole collection, in all its length and breadth, despatched at once. This is national and modish, and not by any means so bad as many would suppose. I can assure the reader that I have often eaten the losh in this way with much relish, although in the mean time we longed for a piece of ordinary European invigorating bread, the want of which is but ill compensated by the other kind of bread, called *bockon*, which the Armenians sometimes, though less frequently, make use of. They take the dough almost quite unfermented, and make flat round cakes about an inch thick, which they bake on the coals or in the oven.

Our military attendants were extremely desirous of finding something more like bread; but here arose the question, how was it possible to bake after the European fashion, without trough, or oven, or table; for neither in the monastery nor in the village was there a wooden or earthen vessel large enough for preparing the dough, wood being in this country, far and wide, an expensive article, and wooden ware, consequently, almost unknown. It was only in Erivan, among the Russians, that such things were to be had; but at starting we had never dreamed of such difficulties. But, to cut the

matter short, our Kossaks contrived to attain their object without any tedious deliberation. Close to the monastery was a steep bank of clay mixed with sand; in this they made a horizontal excavation for an oven; a stone that fitted the opening served for the door; a hollow within it, well coated with plaster, was the trough in which the dough was kneaded, and left for two days to ferment; another levelled and smooth place in the same bank did duty as the table; and so these brave fellows succeeded in making, not only for themselves, but for us also, extremely well-tasted and wholesome bread of good rye meal.

Our whole kitchen apparatus consisted of two iron pots and one pan, which, taken off the fire, were set upon the table without any ceremony; for smaller matters, we had, besides, a pair of tinned dishes, in the Georgian fashion, fitted for travelling, with half a dozen plates tinned in like manner. Each of us had also his silver spoon, his knife and fork, and also his glass, which, in spite of the philosophy of Diogenes, we always kept about us in the course of our journey. As to wood for the kitchen, it was necessary to fetch it from a considerable distance: it consisted only of crooked and broken twigs and branches. For the fire in our own apartment, which during the latter part of our residence here we felt it necessary to light every day, we made use of dry dung, which the inhabitants of these countries collect and lay by for fuel just as we do wood; for this purpose the dry masses are piled up into a pyramidal heap or clamp, as may be seen in our sketch of St. James's, within a slight enclosure before the outer wall; and it is extraordinary how easily the fuel kindles, and what a heat it throws out, without the least disagreeable odour.

As soon as I had recovered a little, I applied myself to the magnetical observations—a branch of inquiry diligently prosecuted of late years by scientific travellers, and justly so, as it conducts to a nearer acquaintance with the earth in respect to the important element of its magnetic power. The instruments used for this purpose differ, however, from the compass, or magnetic needle, as it is ordinarily arranged, and are constructed chiefly with a view to determine, with the greatest possible exactness, the position of the needle, moveable with perfect freedom in all directions. But, since it is difficult to arrange a needle so that it can take all positions with equal facility, it is usual to employ two needles: the one suspended horizontally, and in this plane pointing with the utmost facility of motion towards the north and south magnetic poles; the other capable also of taking a north and south position, but moving with the greatest facility up and down, like a very delicate balance. These observations I found it impossible to make within the monastery, but chose for the purpose two open spots outside, in order to get rid of the influence of iron, which, by attracting the needle, might affect its position; for although in the monastery, as far as it was visible, there was hardly half a pound of iron, yet we had with us a considerable quantity, or at least enough to exercise, when so near, an influence on the magnetic needle.

While I was thus employed, MM. von Behaghel and Schiemann set off on an interesting excursion to the great salt-mines of Kulpe, up the Araxes, 60 miles from Ararat, and not far from the bounds of the Turkish pashalik of Erzerum. There, beneath a mountain several hundred feet high, is found, with strata of gypsum intermixed, a deposite of fine rock salt, of such depth and magni-

tude that, although it has been worked for ages by the inhabitants, and not always in the most considerate or economical manner, yet there is not the slightest symptom of its exhaustion.

CHAPTER IX.

Third Attempt to reach the Summit.—Kip-Ghioll reached on Horseback.—Night near the Snow-line.—Difficulty of the Ascent.—The Summit gained.—Its Form described.—Supposed Resting-place of the Ark.—Prospect from the Summit.—The Cross erected.—Altitude measured.—Descent.—Sunset on the Mountain.—The Author's Account questioned.—Sworn Depositions of his Companions.—Stepan Aga's Statement.—The Armenian Peasants.—Testimony of the Russian Soldiers.—Concluding Remarks.

In the mean time the sky cleared up, the wind lulled, the air was pure; on the mountain, too, there seemed to be more repose, and the thundering sound of falling ice and rocks was heard less frequently; in short, everything appeared to intimate that, notwithstanding the advanced season of the year, a decidedly favourable change had taken place in the weather, and I hesitated not to seize this opportunity for my third attempt to ascend the summit; for enterprises of this kind, whatever be the circumspection necessary on engaging in them, must be executed without delay when the favourable moment arrives. On the 25th of September (7th of October), in the afternoon, I sent to ask Stepan if he would join the party, but received from him an answer declining the invitation; he came, indeed, himself to St. James's, but said that he still felt too sore from the toils of the preceding excursion to be able to make another attempt so soon. Yet he engaged to send me four active peasants, as I desired, and also three oxen with a driver, for hire. The following day, early in the

morning, five peasants, instead of four, came to St. James's to take part in the expedition. Well, the fifth came of his own accord, but I welcomed him, and to these I added two of our soldiers. The deacon also accompanied us on the occasion, and M. Hehn followed us with the intention of studying the vegetation in the higher parts of the mountain, but not of going beyond the limits of the snow.

The experience acquired in my former ascent had taught me that everything depended on spending the night as close as possible to the limits of perpetual snow, so as to be able to reach the summit and to return again the following day, and that, to that end, the loads of the cattle and of the men must be confined to what was absolutely indispensable. I had therefore three oxen only laden with some warm clothing, the requisite supply of food, and a small quantity of firewood. I took also a small cross, made of bars two inches in diameter, but cut of oak, and so put together that the longer piece might serve as a staff to the man who carried it. We directed our course to the same side as before, and, in order to spare our strength as much as possible, Abovian and myself rode this time, as far as the rocky nature of the ground allowed us, to the vicinity of the grassy plain, Kip-Ghioll; we did not, however, leave our horses there as Stepan had done, but sent them back with a Kossak, who attended us for that purpose: from this place M. Hehn also returned.

It was not quite noon when we reached this point. We took our breakfast, and after resting about an hour and a half, we set forward in an oblique course upward, deviating a little from our former track: the oxen, however, could not follow us so fast; one of them, in particular, seemed much weaker than the others; and as it threatened to

cause us no little delay, we deemed it advisable to make ourselves independent of such aid. We halted, therefore, at the base of a towering pile of stones, over which the poor animals could hardly have climbed; we then freed them from their loads, which we distributed fairly among the party, so that each man carried his share of covering and fuel, and this done, we sent back the oxen with their keeper.

About half past five o'clock we were close to the lower border of the snow, and had attained a height considerably above that of our former night quarters: the elevation of this point above the sea was 13,800 feet. The large masses of rock here scattered about determined us in selecting this spot for our night's lodging. A fire was soon kindled, and something warm got ready for the stomach. For me, this repast consisted in onion soup, the use of which I can recommend to mountain travellers in such circumstances as extremely warm and reviving, and better than animal food or meat soups, because these require for their digestion more strength, which they restore, indeed, but not so quickly as to allow you to feel any benefit from them within the usually circumscribed period of exertion. Abovian was unluckily prevented from sharing in this excellent meal, a Church holyday compelling him to fast strictly. And was there fasting, too, with such exertions and toils? Yes, in truth, without ceremony or pretence, and without having told me beforehand, or else I might have provided for him some permitted restorative, as an infusion or tea of bruised pepper, with which he might, without violating the rules of the Church, have sought to renew his strength. The other Armenians, too, observed strictly the prescribed fast, and were satisfied therefore with the bread which

we had brought with us, and with the brandy distributed among them and the soldiers by myself in certain portions—for the use of this stimulant requires much caution where there is a great demand on the physical energies, as in ascending a high mountain, or else it produces an effect the very opposite of that expected, namely, a sensation of weariness, and an inclination to sleep—and the people were too reasonable and discreet to wish for more brandy than I thought it expedient to give them.

It was a delicious evening which I spent here, my eyes at one time set on my good-humoured companions, at another on the clear sky, on which the summit of the mountain was projected with wondrous grandeur, and again on the gray night, spreading in the distance and in the depth beneath me. Thus I became resigned to the single feeling of peace, tenderness, love, thankfulness, submission —the silent evoking of the past, the indulgent glimpse of the future ; in short, that indescribable delightful sensation which never fails to affect travellers at great heights and under agreeable circumstances ; and so, favoured by a temperature of 40° Fahr.—no slight warmth for the atmosphere at our elevation—I lay down to rest under a projecting rock of lava, while my companions still remained for a long time chatting round the fire.

At the first dawn we roused ourselves up, and at about half past six proceeded on our march. The last tracts of rocky fragments were crossed in about half an hour, and we once more trod on the limits of perpetual snow nearly in the same place as before, having first lightened ourselves by depositing near some heaps of stones such articles as we could dispense with. But the snowy region had undergone a great, and, for us, by no means

favourable change. The newly-fallen snow, which had been of some use to us in our former attempt, had since melted from the increased heat of the weather, and was now changed into glacier ice, so that, notwithstanding the moderate steepness of the acclivity, it would be necessary to cut steps from below. This made our progress a laborious affair, and demanded the full exertion of our strength from the first starting. We were obliged to leave one of the peasants behind at the place where we spent the night, as he complained of illness; two others, tired in ascending the glacier, stopped at first only to rest, but afterward went back to the same station. The rest of us, without allowing ourselves to be detained an instant by these accidents, pushed on unremittingly to our object, rather excited than discouraged by the difficulties in our way. We soon after came again to the great crack which marks the upper edge of the icy slope just ascended, and about ten o'clock we found ourselves exactly in the place where we had arrived on the former occasion at noon, that is to say, on the great plain of snow, which forms the first step downward from the icy head of Ararat. We saw from a distance of about half a mile the cross erected on the 19th of September, but it looked so uncommonly small, perhaps owing to its black colour, that I could not help doubting whether I should be able to make it out, and to recognise it with an ordinary telescope from the plain of the Araxes.

In the direction of the summit we had before us an acclivity shorter but steeper than that just passed over, and between it and the farthest pinnacle there seemed to intervene only a gentle swelling of the ground. After a short rest, we ascended, with the aid of hewn steps, the next slope (the

steepest of all), and then another elevation; but now, instead of seeing immediately in front of us the grand object of all our exertions, a whole row of hills had developed itself to our eyes, and completely intercepted the view of the summit. At this our spirits, which had never fluctuated so long as we supposed that we had a view of all the difficulties to be surmounted, sank not a little, and our strength, exhausted by the hard work of cutting steps in the ice, seemed hardly adequate to the attainment of the now invisible goal; yet, on calculating what was already done and what remained to be done—on considering the proximity of the succeeding row of heights, and casting a glance at my hearty followers, care fled, and "boldly onward!" resounded in my bosom. We passed without stopping over a couple of hills; there we felt the mountain wind; I pressed forward round a projecting mound of snow, and behold! before my eyes, now intoxicated with joy, lay the extreme cone, the highest pinnacle of Ararat. Still, a last effort was required of us to ascend a tract of ice by means of steps, and that accomplished, about a quarter past three on the 27th of September (9th of October), 1829, WE STOOD ON THE TOP OF ARARAT.

What I first aimed at and enjoyed was rest; I spread out my cloak and sat down on it. I found myself on a gently vaulted, nearly cruciform surface of about two hundred paces in circuit, which at the margin sloped off precipitously on every side, but particularly towards the southeast and northeast. Formed of eternal ice, without rock or stone to interrupt its continuity, it was the austere, silvery head of Old Ararat. Towards the east, this summit extended more uniformly than elsewhere, and in this direction it was connected by means of

a flattish depression, covered in like manner with perpetual ice, with a second and somewhat lower summit, distant apparently from that on which I stood above half a mile, but in reality only 397 yards, or less than a quarter of a mile. This saddle-shaped depression may be easily recognised from the plain of the Araxes with the naked eye, but from that quarter it is seen foreshortened; and as the less elevation stands foremost, while the greater one is behind, the former appears to be as high as, or even higher than the latter, which from many points cannot be seen at all. M. Fedorov ascertained by his angular measurements, made in a northeasterly direction from the plain of the Araxes, that the summit in front is seven feet lower than that behind or farther west; to me, looking from the latter, the difference appeared much more considerable.

The gentle depression between the two eminences presents a plain of snow moderately inclined towards the south, over which it would be easy to go from the one to the other, and which may be supposed to be the very spot on which Noah's ark rested, if the summit itself be assumed as the scene of that event, for there is no want of the requisite space, inasmuch as the ark, according to Genesis, vi., 15, three hundred ells long and fifty wide, would not have occupied a tenth part of the surface of this depression. Kerr Porter, however, makes* on this subject a subtle comment favourable to the opinion that the resting-place of the ark was not on the summit of the mountain, but on some lower part of it; because in Genesis, viii., 5, it is said, "On the first day of the tenth month the tops of the mountains came forth;" but in vi., 16,

* Travels in Georgia, Persia, and Armenia, &c., Lond., 1821, vol. i., p. 183.

it is stated that the window of the ark was above; consequently, Noah could have seen only what was higher than the ship, which was therefore lower down than the tops of the mountains: on these grounds Kerr Porter is inclined to look upon the wide valley between the Great and Little Ararat as the place where the ark rested. In this reasoning, however, he takes the above quoted texts of Holy Writ in a sense different from the literal one; for it is nowhere said that Noah saw the mountains coming forth, but it is simply stated that after the ark had rested, the waters subsided, so that already on the first day of the tenth moon the mountains began to come forth; then, "after forty days Noah opened the window which he had made in the ark and let fly a raven;" and again, after three weeks, "Noah took off the cover of the ark, and saw that the ground was dry," respecting which he might have formed as good a judgment, or even a better, from the more elevated point than from the lower.

Should any one now inquire respecting the possibility of remains of the ark still existing on Ararat, it may be replied that there is nothing in that possibility incompatible with the laws of nature, if it only be assumed that immediately after the Flood the summit of that mountain began to be covered with perpetual ice and snow, an assumption which cannot be reasonably objected to; and when it is considered that on great mountains accumulated coverings of ice and snow exceeding 100 feet in thickness are by no means unusual, it is obvious that on the top of Ararat there may be easily a sufficient depth of ice to cover the ark, which was only thirty ells high.

From the summit I had a very extensive prospect, in which, however, owing to the great dis-

tances, only the chief masses could be plainly distinguished. The valley of the Araxes was covered in its whole length by a grayish cloud of vapour, through which Erivan and Sardarabad appeared only as dark spots no bigger than my hand. In the south, the hills behind which Bayazed lay were more distinctly visible. In the north-northwest, the serrated head of Alaghés rose majestically, covered in every hollow with large masses of snow —a truly inaccessible crown of rocks. Immediately in the neighbourhood of Ararat, particularly towards the southeast, and on the west at a greater distance, were a number of smaller mountains, for the most part having conical summits, with hollows in the middle, apparently at one time volcanoes. Then towards the east-southeast was the Little Ararat, the head of which no longer appeared as the simple termination of a cone, as it seemed from the plain, but like the section of a truncated quadrangular pyramid, having at its angles and in the middle a number of rocky elevations of various heights. One thing surprised me not a little, and that was to see a large portion of Lake Gokchai, its surface of beautiful dark blue glimmering distinctly in the northeast, behind the high mountains which enclose the lake immediately on the south, and are so elevated that I never should have thought it possible to catch a glimpse, looking over them from the top of Ararat, of the waters which they imbosom.

Having thus surveyed the prospect around, I turned to look after my companions, and missed the faithful Abovian: he was gone, I was told, "to set up the cross." That was what I intended to do myself, and had selected in my mind the round area in the middle, where it would have stood most securely, and in the worthiest place.

But Abovian, influenced by pious zeal, had taken the business in hand, and had looked out a site for the cross on the northeastern edge of the summit, because, as he justly remarked, if it stood in the middle it would not be visible from the plain, being scarcely five feet high. In order to gain his point, that the cross should be visible not only from the plain, but also from Arguri and St. James's, he ventured, at the risk of his life, so far on the steep slope of the margin that he stood full thirty feet lower than the middle of the summit, and consequently had at first escaped my notice. There I saw him hard at work, cutting a hole in the ice to fix the cross in. It was evident that this spot was highly unfavourable for the permanent support of the cross, inasmuch as, from the great inclination of the surface, it was more liable to fluctuations in the ice, and to a progress downward in the mass, to say nothing of sudden falls or *avalanches*—movements which continually take place in the glacier ice of all mountains—and that, in a few years, perhaps, the only memorial of our having been on the summit would disappear from it. Nevertheless, I was ultimately swayed by the reflection that this mark would probably have a long time to wait for the coming of another traveller; and that, on the other hand, it would be no less honourable for us if a signal, visible for the present, at least, from the plain, were to bear witness to the feat which we had been so fortunate as to achieve; but what particularly decided me to leave the cross in this place was, that I hoped to see it made use of as a mark in M. Fedorov's trigonometrical measurement of the mountain.

I let the deacon, therefore, have his own way, and proceeded myself to observe the barometer which I had set up in the middle of the summit.

The mercury in it stood no higher than 15 inches $\frac{3}{4}$ line, Parisian measure, at a temperature of $6\frac{2}{3}^{\circ}$ of Fahrenheit's scale below the freezing point. This observation, compared with that which M. Fedorov was good enough to make contemporaneously in St. James's, gives the summit an elevation of 10,876 feet above the monastery; adding, therefore, the observed elevation of the latter place, Ararat has a vertical height above the level of the sea of 17,210 feet.

There were six of us on the summit, namely, besides myself, Khachatur Abovian, deacon in Echmiadzin, son of an Armenian residing in Kanakir, near Erivan; Alexei Sdrovenko, of the 41st Yäger regiment; Matvei Chalpanof, of the same regiment; Ovannes Aivassian, a native of Arguri; and Murat Pogossian, of the same place.

The deacon, though only twenty years of age, and accustomed to a quiet monastic life, never for an instant shrank from the exertions called for by the undertaking, and showed throughout abundant proofs of his spirit and steadiness, as well as the enthusiasm that animated him for the success of the enterprise. His devout zeal, which excited him in Echmiadzin to follow us, led him also in safety, notwithstanding the manifold hinderance of his monastic costume, consisting of three long and full robes, over the rugged heaps of shattered rocks and the precipitous glaciers of Ararat; made him when on the summit, give all his attention to the cross, without thinking of rest, and from this spot, so dear to him, to carry down to the monastery a large piece of ice, the water from which he kept in a bottle as peculiarly holy.

Alexei Sdrovenko, a stout warrior, distinguished for the part he took in the fierce engagements of our Trans-Caucasian army with the enemies of

Christianity, was a simple, true-hearted man, without guile or vulgarity, modest and quiet in deportment. During this last excursion, as well as on the preceding occasion, he took part, with manly resolution and endurance, in every labour and danger.

Matvei Chalpanof was a youthful hero, of amiable, unassuming manners; free, like his comrade, from servile flattery, he had a proper sense of the respect due to rank, felt deeply every kindness offered to him, and quite devoted himself in lending me the assistance which I required in the descent. He, too, seemed to have in his heart some conception of the high import of the object aimed at, and this he manifested in a way peculiar enough, but suited to his rank and station; for in ascending the summit he had under his cloak, not, as I supposed, some clothing as warm and comfortable as possible, but his dress uniform, arranged and decorated in the best style, as if he were going to parade.

Ovannes Aivassian, a young man twenty-six years of age, of extraordinary bodily strength and activity, fine, tall stature and agreeable countenance, was on this occasion the individual who underwent the greatest fatigue, inasmuch as he offered more frequently, and for a longer time than any of us, to be the foremost of the file.

Murat Pogossian, thirty years old, differing, in his small stature and round features, from the general physical characteristics of his countrymen, was that unbidden guest who came of his own accord with the others to St. James's to attach himself to the expedition, which gained, nevertheless, little from his presence, so far, at least, as bodily labour was concerned; for, although he held out to the last, and never was a burden to us, yet he strove as much as possible to lighten his own task, and was

always the last in the line, so that he could use the large steps already cut for him in the ice, and every now and then sat down to rest till we had made some farther progress in the work. But, notwithstanding this, he was a welcome companion to the party on account of his gayety and high spirits. He was a sort of droll, who, while his comrades were working for him, kept them in good humour by his jokes and smart sayings.

After staying on the summit about three quarters of an hour, we began to think of returning, and by way of preparation took each a morsel of bread, while at the same time, from the small quantity of wine brought with us, we gladly poured a libation to the Patriarch Noah. We then went, one after the other, rapidly down the steep, by means of the deep steps cut in the ice during the ascent; yet the descent was still extremely fatiguing, and to me, in particular, caused much pain in the knees; nevertheless, we hastened on, as the sun was already low, and before we reached the snow-plain of the great cross, it had sunk below the horizon. It was a magnificent spectacle to observe the dark shadow thrown on the plain by the mountains beneath us to the west, then the deep darkness which encompassed all the valleys, and gradually rose higher and higher on Ararat, while now only its icy head was illumined by the rays of the sunken orb; but they soon shot above that also, and our path downward would have been involved in perilous darkness had not the luminary of night arisen in the opposite quarter of the heavens to throw a clear and lovely light on our footsteps.

About half past six in the evening we reached our place of bivouac, where a cheerful fire was made with the wood that remained, a small supper cooked, and the night, as bright and warm as the pre-

ceding one, spent agreeably. There also we found our attendants whom we had left behind, together with our things. The next day, about six in the morning, we set off, and about half past eight reached Kip-Ghioll, where the beasts of burden were waiting for us, and about noon on the 28th of September we joyfully entered St. James's, as the Patriarch Noah, "with his sons, and with his wives, and with his sons' wives," had, 4000 years before, descended from Ararat. On the day after our return, in our Sabbath devotions, we bore to the Lord the offering of our thanks, perhaps not far from the very spot where Noah "built an altar to the Lord, and offered thereon burnt offerings." The evening of our return was celebrated by the discharge of some rockets, which we owed to the kindness of M. von Dunant, captain of artillery in Erivan.

I hope that the reader, confiding in the veracity which, in my opinion, is the first duty of every one who puts a statement on record, will have followed the preceding narrative without mistrust, and have rested in the belief that I was actually on the summit of Ararat. It is therefore reluctantly, but not without sufficient grounds, that I come to the decision to add here a few words in respect to the possibility of my practising any mystification on the public. It must be taken into consideration that many years may elapse before another attempt be made to ascend Mount Ararat, or, what would be worse for me, that circumstances, which are not always under the control of travellers, may defeat such an attempt; then it might easily come to pass that the old preconceived opinions respecting the impossibility of ascending Mount Ararat would revive, and along with them, doubts (at least with some people) respecting the truth of my narrative —doubts which, besides, already live in the breasts

of many Armenians strongly attached to the tenets of their creed, and openly expressed by them while I was still in their country, though not by way of personal attack on me.

In the mean time, so overpowering was my sense of good fortune in having attained the so ardently desired object, so firm was my reliance on that confidence which the educated public had reposed in me and the narrative of my earlier travels, that no thought nor apprehension of the contrary entered my mind, and any measure taken to counteract suspicion would have appeared to me to partake of ingratitude and injustice. I was, therefore, the more pained and taken by surprise, when, a full year after the termination of this journey, a man belonging to the educated European public—a man of merit in his way—one who, on account of his long residence in those countries, possesses undoubted claims to confidence in his local knowledge—I was grieved and surprised, I say, to find that this man was the first to cast a stone against me, and in a published commentary to insist on the impossibility of the fact asserted by me. I have done what the honour of my name demanded. The well-known and highly-valued "Tiflis Chronicle" contains, in numbers 11 and 22 of the year 1831, the hostile comments and the answer to them, and there the affair seems to have ended; yet, being roused by this prelude, and desirous to contribute as far as lay in my power to the confirmation of the truth, I called for (and trust that I shall be excused for so doing) the sworn depositions of the persons who accompanied me to the top of Ararat. These depositions respecting our whole proceedings on that occasion, the originals of which were transmitted to me through the kindness of Prince Lieven, the minister of public instruction I here take the lib-

erty of giving, translated word for word, which I should not have hesitated to do, even if dark superstition had made free with the truth to my prejudice to a much greater extent than it has done in two of the documents which here follow:

1. "In consequence of your highness's letter of the 25th of July, No. 5793, in reference to the inquiries called for by M. Parrot, professor in the University of Dorpat, respecting the reality of the expedition carried into effect by him on Mount Ararat, Adjutant-general Pankratyef issued the requisite order to the commander of the province of Armenia. As the result of that, Major-general Prince Bebutof has just sent me, in accordance with the wishes of M. Parrot, the declarations on oath of the following persons: viz., 1. Alexei Sdrovenko; 2. Matvei Chalpanof; 3. Stepan Aga Melik, the elder of the village of Arguri; and, 4 and 5, of Murat Pogossian and Ovannes Aivassian, inhabitants of the same village.

"Transmitting herewith those declarations of eyewitnesses and the assurances of the abovenamed persons as to the truth of the depositions, I have the honour to be, with the utmost respect and submission,

"Your highness's obedient servant,
"Baron G. Rosen,
"Commander of the Trans-Caucasian Provinces.

"Tiflis, 5th December, 1831.
"His Highness Prince Lieven."

2. "*Deposition on Oath, taken from Melik Stepan Aga, the 12th of October, 1831, in the presence of the Lieutenant-superintendent of Police, Litvino, by the Armenian priest, Ter Avetis Kahanna.*

"In the year 1831, on the 12th of October, in

the presence of the police authorities of Erivan, the inhabitant of Arguri and elder, Melik Stepan Aga, being interrogated on oath respecting the journey to Mount Ararat executed in the year 1829, under the direction of M. Parrot, professor in the University of Dorpat, made the following statement:

"'My name is that stated above; I am fifty-three years of age, and go every year to confession and to the holy sacrament; I do not know how to read or write. In September of the year 1829—I cannot now recollect on what day exactly—the professor named Parrot came into the village of Arguri for the purpose of measuring Mount Ararat. There came with him at the same time a deacon from the monastery of Echmiadzin, bringing me the order or the entreaty of the monastery that I would lend every possible assistance to Professor Parrot in his ascent of the mountain, which was the object of his coming. I consented to do so; and I offered to M. Parrot, after he came to the village of Arguri, to show him a place whence he could proceed to ascend the mountain. He had meditated making that attempt with his own party alone, but could find no practicable place to start from. In consequence, I set off the day after his arrival, attended by about five inhabitants of Arguri, and on the first day of M. Parrot's enterprise, we reached the place where the snow begins, and beyond which there are five mountains of snow. There we spent the night. The next day we all, M. Parrot with his companions, and I with the villagers, advanced farther over the snow that covered the mountain. When we had ascended the first mountain of snow, we found, opening beyond it, a sort of plain, extending about two thirds of a mile. Then began a second mountain. After we had ascended about half way up this, M. Parrot erected,

about noon, a wooden cross, and fastened on it a leaden or tin plate, with an inscription, the meaning of which was unknown to me. Soon afterward a fall of snow, though not a very heavy one, took place, and M. Parrot, fearing that it might fall upon him there, turned back immediately, and we with him, and in the evening we reached the place where we had spent the first night, that is, close to the snow, and the third day we arrived at the monastery.

"'But some days afterward Murat Pogossian and Ovannes Aivassian also went up the mountain, and erected, as I have heard them say, another, though smaller cross than the first, in a different place indeed, but in respect to distance not higher than the first. M. Parrot gave me for my attendance on him three ducats, and to the villagers whom I took with me two or three ducats. As to ascending the highest summit of Ararat, that is quite impossible, partly on account of the terrible cold, which makes it difficult even to draw one's breath, even where the cross was erected, but chiefly because the mountains, rising beyond the place of the cross, fill one with terror at the first view of their steepness, and no longer covered with snow, but all of ice, they rise like great walls; and even, in order to succeed in reaching the place where the cross is erected, it is necessary that the ice on the mountain should be covered with snow. With respect to the length of time which would be required to reach the summit (supposing this to be possible), it is the more difficult to estimate it, inasmuch as no one ever reached before even the point where the cross is erected; and in climbing the mountain to the place here indicated, I and the villagers were often obliged to haul up M. Parrot and his companions with ropes.' (This goes somewhat beyond the prescriptive bounds of Oriental

hyperbole: it is altogether a fiction. I remember well the attempt we made to drag up the great cross with a rope; but, in truth, neither myself nor my companions ever resorted to such ridiculous aid.)

"'As to the place where M. Parrot resided with his expedition, I have the honour to state, that during the whole time the headquarters of the expedition were in the Armenian monastery named Surb Hagob (St. Jacob or James), not far from the village of Arguri, in which, nevertheless, they did not reside. The plague was not in Arguri at the time the expedition to Ararat was in the neighbourhood, but had ceased a little before. The preceding statement I have made sincerely, and in conformity with the truth, and in confirmation of it I now sign my name.'

"Inasmuch as Melik Stepan Aga, inhabitant of Arguri, does not know how to write, I have signed for him at his request.

"MAKERDICH KHIALLOR.

"LITVINO, Lieut.-superintendent of Police.

"POIO, Government Secretary."

3 & 4. "*Depositions on Oath, taken on the 15th of October*, 1831, *from Murat Pogossian and Ovannes Aivassian, by the Armenian priest Ter Sakar, in presence of the Lieutenant-superintendent of Police, Litvino.*

"In the year 1831, the 15th of October, Murat Pogossian and Ovannes Aivassian, inhabitants of the village of Arguri, in the district of Surmalinsk, being interrogated on oath in the presence of the police of Erivan, deposed as follows:

"The first named: 'I am thirty years of age, and go every year to confession and to the holy sacrament: I am unable to read or write. In the year 1829, as well as I remember, there came to

the monastery Surb Hagob (St. James), not far from Mount Ararat and the village of Arguri, the professor named Parrot. This person, on the third or fourth day after his arrival in the monastery, set off with Melik Stepan Aga, the elder of Arguri, to ascend Mount Ararat. On the evening of the third day they returned from their excursion to the village whence they had started, and I learned that M. Parrot had erected a cross on the mountain, yet not on the highest part of it. Three days afterward, as well as I can remember, I went, with six other people, at the command of Melik Stepan Aga, to accompany M. Parrot, by the same track which he had already explored, once more to the top of the mountain. We spent the first night not far from the snow; the second day four of the Arguri people were so fatigued as to be obliged to stay behind; but myself and Ovannes Aivassian, an inhabitant of our village, went on with M. Parrot, and by his account we went nine hours. M. Parrot erected a cross, and fixed on it a plate with an inscription which I did not understand. This cross was set up towards the right from the village; that erected before was towards the left, as I have been told. During our return from Ararat the weather was fine and sky clear. M. Parrot gave each of us a ducat for our trouble, but those who stayed behind received each a silver ruble. We were not on the very summit, and could not get there, because farther on there is no snow lying, but only ice; and besides, the steepness of the slope allows no farther progress. The extreme cold did not permit us to spend the night on the top of the mountain.'

"The deposition of Ovannes Aivassian is simply confirmatory of his comrade's, and they are both signed in the same manner as that of Melik Stepan Aga."

5 & 6. "*Affidavits of Matvei Chalpanof and Alexei Sdrovenko, soldiers of the* 41*st Yäger regiment, taken by the high-priest Vassili Romanof, in presence of Lieutenant Stepanof, of the* 41*st Yäger regiment.*

"On the 2d of November, 1831, by order of Colonel Stepanof, commandant of the 41st Yäger regiment, founded on a letter of Major-general Prince Bebutof, commander of the province of Armenia, Matvei Chalpanof, soldier of the 41st Yäger regiment, was interrogated on oath respecting the journey which he made in 1829, in company with Professor Parrot, of the University of Dorpat, and replied as follows:

"*Question.* Were you on the top of the mountain the 27th of September, 1829, with Professor Parrot, of the University of Dorpat?

"*Answer.* I was, in fact, with Professor Parrot on the top of Mount Ararat in the month of September, 1829, but I do not remember the precise date.

"*Q.* From what place did the journey begin?

"*A.* It commenced from the monastery of St. Gregory, which is situate at the foot of Mount Ararat.

"*Q.* What time was spent in the excursion, and where did you halt for the night?

"*A.* Our journey from the monastery of Saint Gregory* to the top of the mountain and thence back again occupied three days. The first night we encamped close to the snow; the second, on our return, we spent in the same place; and on the third day we returned to the monastery.

* This name, St. Gregory, it must be observed, was due to erroneous information given us by the archimandrite. It was at a later period of our residence there that we ascertained that the monastery is properly named after St. James.

"*Q.* About what time of the day were you on the summit?

"*A.* We arrived on the summit about two o'clock in the afternoon, and returned after we had stayed there not longer than two hours.

"*Q.* What was the state of the heavens when you were returning from the mountain; that is to say, was the sky clear or cloudy? was it day or night?

"*A.* The weather was fine and clear as we descended from the mountain, about an hour and a half before sunset.

"*Q.* What did you do on the summit?

"*A.* A small wooden cross, not more than three feet and a half high, was erected on the summit, high above the surface of the snow, and fixed firmly in the ice.

"*Q.* What remuneration did you receive from M. Parrot for your services on this expedition?

"*A.* After our return into the monastery of Saint Gregory I received a ducat from M. Parrot on account of this expedition. When I came back to Erivan I received ten silver rubles from my commanding officer on the same account.

"*Q.* Have you, on your oath, spoken the strict truth on the various points respecting which you have been examined?

"*A.* I have, on my oath, spoken the strict truth.

"This examination took place in the presence of the officers of the 41st Yäger regiment, whose names here follow:

"Major Litvinniko.
"Lieut. Stepanof.
"Sub-Lieut. Dukhnofski.
"Ensign Lasarevich.
"Ensign Shukofski.

"The testimony of Alexei Sdrovenko is exactly similar in all points to that given above, and is authenticated in the same manner."

Whoever takes a nearer interest in these matters may easily, and without any lengthened commentary on my part, judge on which side the truth lies, merely by comparing these various depositions with my statements and remarks, written on the spot, in minute detail. I need here only mention, in order to set aside the doubts respecting the publicity which I gave to the enterprise from the beginning, that the "Tiflis Chronicle"* of October, 1829, contains not only the information respecting my journey to the summit of Mount Ararat, sent by me immediately to the editor, but also the account of the barometrical measurement of the height of the mountain, which could have been executed only by observation of a barometer on the very summit. Now that barometrical measurement agrees within 200 feet with the trigonometrical measurement executed by M. Fedorov in the first half of October, from the plain of the Araxes, the observations for which he despatched, without knowing their result (as the calculation of them would have taken some time), together with a copy of the rest of his journal, to the Council of the University. He calculated them, in fact, under the eyes of Professor Struve, in Dorpat, after his return, and not till then.

The deacon, on his return from the summit, found in St. James's an order for him from Ech-

* This periodical, edited by M. P. Sankovski, is distinguished by the solidity and copiousness of its information, statistical, ethnographical, scientific, geographical, and historical, respecting the important, and still so imperfectly known, Trans-Caucasian provinces. It has appeared since 1828 in the Russian language; it was at first published also in Georgian and Persian.

miadzin to quit us and proceed at once to his monastery. Although this was contrary to my views, and to the promises made to me in Echmiadzin; though there was no reason assigned for it, and, as circumstances showed, it was not occasioned by any meditated scheme of translation, yet I allowed the young man to go immediately, bearing a courteous letter to Father Joseph, in which I plainly expressed my wishes and my expectations. The deacon, immediately on his arrival in Echmiadzin, was led before the priests assembled round the patriarch. There he gave an account of our attempts to ascend Ararat, and handed also to his superiors the bottle of water from the ice of the summit. Some tasted it, others sprinkled themselves or wetted their faces with it; all looked upon it as a rarity of the highest value. Finally, they were good enough not to detain the deacon any longer, and on the third day, to his great satisfaction, he returned again to St. James's.

CHAPTER X.

Geology of Ararat.—All Volcanic.—Traces of Porphyry.—The Mountain a Heap of Ruins.—The Lavas described.—The Flora of Ararat.—Characters of Alpine Vegetation.—Plants become Dwarfish.—Species enumerated.—Limits of arborescent Vegetation.—Limit of perpetual Snow.—Relatively high on Ararat.—Its Irregularity.—Glaciers.—Excursion to Kulpe.—Irrigation.—The Salt-mines.

The three greater journeys to the top of Ararat, and the several less excursions which I made from the monastery, gave me opportunities of becoming tolerably well acquainted with the geological constitution of that mountain. The general result is, that every rock found upon it, whatever may be its appearance, is volcanic: here, masses of regu-

larly melted lava; there, cinders; there, trachytic rock in various gradations of colours, thickness, and composition, with plain marks of the agency, more or less violent, of volcanic heat. Almost universally, these masses of rock exhibit, with greater or less distinctness, the characters of porphyry.

In many specimens of these stones, it is impossible to overlook the similarity to, in some the complete sameness with, those which M. Kupffer found on Elbrus in Caucasus, and has fully described.* These he had the kindness to send to me to examine.

Such being the prevalent mineral character, it is vain to talk of a regular distribution, in strata, of different kinds of rocks. Nay, it can hardly be asserted positively that any one portion of the mountain, of considerable extent, consists of this or that kind of rock. On the contrary, the fact seems to be, that fragments are there heaped on fragments, ruins on ruins, till the accumulations spread so wide and reach to such a depth as to pass for rock in its original situation. The various masses generally met with on Ararat may be comprised under the following denominations:

1. Blackish porphyry lava, with here and there vitreous feldspath, heavy, yet full of small, longish cavities, and belonging to the most peculiar volcanic masses of Ararat.

2. A blackish cinder-like lava, with great, lengthy cavities, which are thickly clothed with oxides of iron.

3. A black pitch-like lava, very dense and heavy, is of frequent occurrence, in enormous blocks, in the highest regions, as well as

4. Pitchstone-porphyry, and

* Voyage dans les Environs du Mont Elbruz en 1829, par M. Kupffer, St. Petersb., 1830.

5. A dark steel-gray, dense porphyry lava, with red veins and vitreous feldspath.

6. A beautiful medium gray volcanic stone, with vitreous feldspath, likewise occurs frequently in scattered blocks, and also apparently *in loco*, on Ararat. It is particularly well adapted for cutting and turning, and I have had the good fortune to be allowed to present a little cross made of it to her most gracious majesty the Empress Alexandra Feodorovna. These masses of porphyry, altered by fire, for such they are in reality, are to be found of many shades of colour, bright and dark gray, reddish gray, passing into brilliant red, and also of various degrees of solidity.

7. Steel-gray clay porphyry, with fainter traces of volcanic action, is found on Ararat, at a height of 9000 or 10,000 feet, in level beds, as if stratified and *in loco*.

8. Pozzuolana, generally brown, porous, with vitreous feldspath, in great or small spherical masses, and passing by disintegration into volcanic sand.

9. Black lava, very light, like pumice, with cavities about the size of beans, apparently *in loco*, and also in spherical pieces worn round, is to be found on Ararat and about it, to a great distance northward, even beyond the Pambak Mountains.

10. Obsidian porphyry, which is very common in the upper and middle region of Ararat, and

11. True obsidian, in greater and smaller masses, particularly on the western side of the mountain.

12. In conclusion, M. von Behaghel found at the foot of the glacier in the dark glen, on the débris, a large mass of a salt which Professor Goebel has had the goodness to analyze,* and which is found to contain

* Schweigger-Seidel, Journal für Chemie und Physik, 1830, part 12.

Sulphate of aluminum - - - -	97·3
Sulphate of protoxide of iron - -	2·7
	100·

A rich harvest in a botanical point of view was not to be expected from these excursions, partly on account of the already mentioned dry and rocky character of the country, where even the vegetation of lichens and mosses can hardly obtain a firm hold on the hard masses of lava, and partly on account of the advanced season of the year, when such a number of small plants were already withered so as to be no longer recognisable. So much the more diligently did I gather whatever plants were to be found on the slopes of the lower region of the mountain, where they had any covering of soil, or between the stones higher up. I recognised throughout the peculiarities characteristic of vegetation at great heights, the striking changes in the structure of the plants generally, as well as the modifications of individual forms.

It has been long since observed to be the distinguishing character of Alpine vegetation, that plants, whether they be trees, bushes, or of humbler growth, manifest, in their whole development, an effort to rise as little as possible above the ground on which they stand, and consequently have their stem or stalk either short and strong, or crooked and bent down, while the leaves and flowers are more compact, and placed more closely together, than on the same kind of plant in a lower situation. The general reason of this change is, that the plants can bear only a certain degree of cold, and since the warmth of the air is derived by radiation from the earth, which is heated by the sun, while the ground on high mountains is cooled more rapidly by the cooler state of the atmosphere, it is easy to under-

stand that those plants which at the bottom of the mountain grow a foot high, may, on the summit, meet, at the height of two inches only above the soil, the limits of temperature which confine their growth. Thus the trees first become dwarfish, then the bushes, and so the other plants in proportion to their usual size and their power of living under a ruder climate.

But, besides this general change of structure in plants at great heights, they also undergo some special alterations with respect to their several parts. The root ordinarily becomes strong and thick when the soil is not too deficient in nutritive particles, the transition of which into the sap of the root cannot be anywise hindered by the elevation of the site. The flowers are quite perfect in size and every other particular. They unfold on Alpine plants in great luxuriance and with remarkable freshness of colour, and if a plant be followed on great heights to the very farthest limit at which it grows, it will be found that its flowers are there relatively but little diminished, never deformed, and rather more dense and richer than usual. Even their fructifying power seems to despise the influence of the more elevated region, for the chief function of the petals consists in giving out gaseous or vaporous particles—a function which is rather promoted than impeded by the rarefaction of the atmosphere.

On the other hand, the leaves, the cuticle covering the stock, and, in short, everything green about the plant, dwindles with the increased elevation of the place, and it is striking enough to observe that those parts which, on account of their greater strength, seem much more capable of resisting cold than the flowers, are uniformly subjected, as they rise to greater heights, to a diminution

of their vital functions. In the grasses, and other plants with slender leaves, this is less apparent; but it is remarkably striking in every other kind, the leaves of which become smaller the higher up it grows, until, at last, they no longer retain their natural form; they exchange also their pure, well-defined green for an ill-defined light yellow, and get the look of a thin membrane, all which changes unquestionably arise from the attenuation of the atmosphere, from which the leaves are destined to derive their nourishment.

These changes in plants, resulting from height of situation, were first observed by me during my travels in Caucasus, on which occasion I accurately described them.* I subsequently made the same observations on the Swiss and Italian Alps,† and on the Pyrenees,‡ and now they were again repeated in the most unequivocal manner on Ararat, so that several different kinds of plants occur equally under the same circumstances on all those mountains, the several specimens coinciding most completely, whereas they have so little resemblance to the very same plants growing in the lower regions of the same mountain tract that one would hardly suspect them to be of the same species. It was peculiarly agreeable to me to find on Ararat, as the highest plant, the same remarkable Cerastium which I had formerly gathered on the Kasbeg in Caucasus, far above the limits of perpetual snow, and to find it with the same singular anomalies of structure—the same Cerastium which M. Meyer met with on the heights of Elbrus. The specimen of this plant gathered on Ararat coincided so perfectly with the

* Travels in the Krim and Caucasus by Engelhardt and Parrot (in German), Berl., 1815, vol. ii., p. 85.

† Fr. Parrot on Mount Rosa, in Schweigger's Journal, vol. xix., pt. 4.

‡ Natural-Historical Memoirs, from Dorpat, vol. i., p. 257.

others, that, when compared together, it was impossible to find any difference or mark enabling me to say which came from the Mountain of Noah and which from that of Prometheus.

In the same region with this Cerastium, that is, about 12,000 or 13,000 feet above the level of the sea, I found also *Saxifraga muscoides*, with numerous flowers, but with the leaves extremely small, contracted towards the root, and membranous; the specimens gathered at a somewhat lower elevation approached much more nearly to the ordinary appearance of the plant. A pretty little plant, and a lovely ornament of these savage rocks, was the *Aster Alpinus*, having the same characters here as on the summit of the Kasbeg—the leaves very small, the stem scarcely half an inch high, but the flowers quite fresh, tolerably large, and of a beautiful violet colour. In company with it was to be seen *Draba incompta*, partly in flower, partly with its seed ripe; also *Arenaria recurva*, as well as the pretty *Aster pulchellus*, with its tufts of blossoms on a short stem, with small leaves, in consequence of the vicinity of perpetual winter, yet losing nothing of the clearness and splendour of their lilach tint. The influence of climate was also very characteristically exhibited in *Campanula saxifraga*, and exactly as I had found to be the case with the kindred *Campanula rupestris* on Caucasus, and *Campanula cespitosa* on the Pyrenees. In like manner, *Pyrethrum Caucasicum* is found on Ararat, just as *Pyrethrum Alpinum* on the Pyrenees; and, still farther, *Tragopogon pusillum*, with ample blossoms, and *Saxifraga Hirculus*, here occur, as three other saxifrages do on the heights of Caucasus. *Astragalus mollis* had lost its flowers, but I found on it very large seed-vessels, which were very remarkable in contrast with the little, con-

tracted, woolly leaves; and also a *Potentilla* showed, in the higher regions of Ararat, as *Potentilla grandiflora* does on Caucasus, the characteristics of elevated situation.

At a somewhat less height, or between 10,000 or 12,000 feet above the level of the sea, I found, altered in like manner, but to a less degree, besides the foregoing, *Anthemis rigescens* also, which here takes the place of *Anthemis montana* on the summits of the Pyrenees, and of *Anthemis Rudolphiana* on the heights of Caucasus. With these were *Ziziphora media*, *Scorzonera coronopifolia*, *Veronica Telephiifolia*, *Dianthus Petræus*, *Statice echinus*, *Hedysarum Caucasicum*, *Trifolium trichocephalum*, with large clusters of violet flowers contrasted with extremely small leaves. *Pulsatilla albana β*, *Centaurea pulcherrima*, and *Centaurea ochroleuca*, occurred here exactly under the same circumstances as on the high mountains of Caucasus. Of shrubs I found but two in the lower region, about 7000 or 8000 feet above the sea, namely, *Juniperus oxycedrus*, and *Cotoneaster uniflora*, with the fruit ripe.*

It is not easy to determine the limits of arborescent vegetation on Ararat, since the checks of climate are there not more powerful than the local hinderances of every kind which prevent the increase of trees on the mountain. Tall walnut-trees, apricots, willows, and Italian poplars (these last, however, of diminished size) can still grow well at the height of 6000 feet above the sea, provided they find soil and moisture, as is seen at St. James's. That birches, also, though no longer straight and tall, are yet not overpowered by the climate at the height of 7800 feet, is proved by the wood at the foot of

* The correct botanical names of these plants I owe to Professor Ledebour.

Little Ararat. This observation also coincides in a remarkable manner with the limits of the birch on Caucasus, at 6700 feet above the sea.

Another object which I had in view when I ascended Ararat was to observe the limits of perpetual snow. The law of nature which gives rise to these limits is this, that the higher we ascend, the more rapidly does the warmth of the air diminish, inasmuch as that warmth proceeds from the action of the solar beams on the earth's surface. If a mountain, then, rises to a great height in the atmosphere, we find it encompassed, the higher we ascend it, by colder strata of air. Its surface, it is true, still receives heat from the sun's rays, but this is not sufficient to compensate the cooling effected by the colder stratum of air; and consequently, on every mountain, as the elevation increases, the heat diminishes, in the ground as well as in the air, which diminution may be assumed to be, on an average, one degree for every 300 feet of ascent. From this it naturally follows that on every mountain of sufficient height there must be a region where the snow that falls during winter cannot be completely melted by the heat of summer; the lower margin of this region is what is called the limit of perpetual snow. Its height depends, in truth, on many local and temporary circumstances which render it variable, as, for example, the greater or less heat of summer; also on the geographical situation of the mountain whereon the snow-limit is sought; on the character of the ground, as whether it be barren or productive—whether it be furrowed by glens and valleys, or be uniformly inclined. Thus a line perfectly constant, and bounding a horizontal plane, is not in this case to be thought of; those disturbing circumstances must be always taken into consideration: and then the

region of perpetual snow will be found to be, within certain limits, capable of being determined with tolerable precision.

The time of the year when the snow-limits are observed must be particularly noted. On that point it may be laid down, in general, that it is only in the end of autumn, before winter has brought much new snow, and when the heat of autumn shall have melted as much as it can of the old, that such observations can lead to a correct result. For mountains such as Ararat, Caucasus, the Alps, the Pyrenees, and, in general, all mountains in middle latitudes, August and September are the only months which can be used for determining the true limits of perpetual snow, because during these months, although the great heat of summer is for the most part gone by, yet large masses of snow still go on melting away, till the actual setting in of winter in these regions puts a stop to this process.

In the case of Ararat, the mean height of the snow-line is raised by the following circumstance: in the country around there reigns an extraordinary degree of heat, the rays of the midday sun striking directly on the south side of the mountain, while on its northern side the valley of the Araxes preserves to a late season of the year the heat received from the slopes of the Gokchai Mountains. In July and August the people fly from the sultriness of the plain—a sultriness which did not allow me, in the latter half of October, to make any exertion out of doors in my usual clothing. At the end of that month the thermometer still stood at 68° Fahr. This excessively hot air continually ascends during the summer up the sides of Ararat, warming its soil, and encroaching uninterruptedly on its snows. In this way alone can I explain the great heat which allowed me, in the latter end of

September (old style), to spend two nights on bare rocks in the open air, without a pelisse, and at the height of 13,800 feet above the sea. If to the circumstance of the warm streams of air rushing up the sides of Ararat the greater part of the year, we add the isolated position of that mountain, the icy head of which is the only one in a very wide tract that rises to a great height above the surrounding country, and which is therefore, of course, less able to resist the influx of warmth from below than a more widely-extended mass of snow, such, for example, as occurs in the Alps, we can explain satisfactorily enough the extraordinary height of the snow-limits on Ararat, which, according to my observations, are 14,080 feet above the level of the sea.

On each of my three journeys to the summit I fixed my attention chiefly on those places where the great cone of snow, which forms the upper fourth part of Ararat, descended without interruption on uniformly inclined slopes, and I determined their heights. Thus I found the border of the perpetual snow of Ararat, on the east side of the mountain, on the 18th of September, to be 13,955 feet; on the 18th and 27th of September, on the northwest side, 14,239 feet above the sea; the mean of both observations being, as already stated, about 14,080 feet. I am not at all surprised that the eastern side of the mountain should thus appear to be warmer than the northwestern, for this latter is quite removed from all radiating surfaces, whereas on the eastern side, and at no great distance, rises the Little Ararat, a mountain 13,000 feet high, the sides of which, warmed by the sun's rays, must necessarily affect the snow-limits on Great Ararat.*

* The author has here fallen into some error. The northwestern side of the mountain would appear, from the greater height of the snow-line, to be warmer than the eastern. This, if it be the fact, may be ascribed to the different temperatures of the winds to which those sides are respectively exposed.—Ed.

This immovable covering of ice and snow sends down from its lower border as many offshoots as there are rocky glens and valleys on the sides of Ararat, and hence the snow-limits of this mountain present to a distant observer the singular appearance of a beautiful pointed collar of a dazzling white material on a dark ground. These offshoots, which may be called glaciers (though not with strict propriety), constitute, from their permanence, a portion of the snow-limits, and I have found their lower edge in one instance, on the eastern side of the mountain, at the height of 12,360 feet; in another, on the northwestern side, at 12,500 feet, by exact measurement, and in many places besides at an equal elevation, judging by the eye. The deepest masses of imperishable ice and snow occur in the dark glen of St. James; but, as I have never been near them myself, I am unable to state their height exactly.

A short time before my last expedition to the top of Ararat, M. Schiemann and M. von Behaghel had made, as has been already stated, a short excursion to the salt-works, celebrated throughout Armenia, and a few hours after me they also returned home. An account of this excursion will be found in the following extract from a letter, sent by M. Schiemann to one of his friends, and communicated to me for publication:

"We had heard so much of the salt-mines near the village of Kulpe, said to be two days' journey from our monastery, that we resolved to examine them with our own eyes. As Professor Parrot made no objection, we set off, M. von Behaghel and myself, attended by four Kossaks, on the 24th of September. One of our Kossaks, who had been in Kulpe, and understood the Tatar language, undertook to be our guide and interpreter. We rode

to the Araxes, and halted on its right bank, which is tolerably well cultivated. We passed by several villages, the inhabitants of which stared at us with amazement. In this tract we again saw some willow-trees, on which storks, here regarded as sacred birds, had made their nests. The whole country around is a sandy desert, on which there grows only a sort of astragalus, and that but scantily. The soil is so dry that the inhabitants are obliged to irrigate their fields frequently in order that some produce may reward their toilsome labour. They irrigate them in the following manner: Several villages join together, and by their united exertions dig a small narrow canal along their fields, which takes its water from the Araxes. From this canal a number of channels lead to their fields, which are laid out with deep furrows. Each owner then uses the canal for a certain time, till he has completely watered his field. When his wants are satisfied, he closes the channel leading to his ground. His neighbour then, in like manner, makes use of the canal, and so the work goes on.

"In the evening we came to a large Armenian village called Tashburni. We made up our minds to spend the night here, because the next village was too far off, as our Kossak said, to allow us to reach it before it was quite dark. We sent for the aga, as the elder or sheikh of an Armenian village is called, asked him for lodging, fodder for our horses, and some fruits, melons, and arbutus. He was for giving us everything. After we had taken our tea, the aga returned to us, bringing melons and other fruits, and entered into conversation with us through the interpreter. In the mean time a handsome carpet was spread on the floor, and several dishes of fowl and rice, dressed in various ways, were set on it. Our friendly host pressed

us to eat. We said that we were not hungry, and had not asked for such a treat. He replied that we were such dear and valued guests that he wished to show us all the attention in his power, so as to convince us of his friendship, and that he should feel hurt if we refused. We therefore seated ourselves near the carpet, while our host gazed on us with admiration as we ate the rice with spoons, which are unknown in this country, where the fingers supply their place. When we had taken our meal, a couple of carpets were brought us, and we made ourselves as comfortable a bed as was to be had.

"The next morning we called for the aga, and asked him how much we were to pay for his entertainment. This seemed to offend him, and he replied that he felt honoured by our accepting his services and lying under his roof; he would therefore take no payment, and hoped that on our return from Kulpe we would favour him with another visit. We then thanked him for his friendliness and hospitality. As we rode from this place we passed frequently by great fields of melons and arbutus, in which the people were employed gathering the produce. On the Araxes, which often divides into numerous branches, we saw immense flocks of ducks, geese, herons, pelicans, cranes, and countless snipes, all which, however, were so shy that it was impossible to get near enough to fire at them with effect. I also saw here a multitude of sandpipers, named by Temminck *Pterocles arenarius*, by Pallas *Tetrao arenarius*—pretty birds, which flew round in great flocks, and filled the air with their very peculiar gurgling cry. As a figure of this bird is to be found among the illustrations of Pallas's travels, I here omit the description of it.

"About midday we halted in a Tatar village

called Akhmameth, and had ourselves conducted to the Yus-Bassa (as the village chief is called by the Tatars), who received us very coldly, and scarcely deigned even to salute us. We were permitted to buy fodder for our horses, but it was not without a great deal of trouble that we obtained this. In a short time a great crowd of Tatars gathered round us, gaping at us with curiosity. Their attention was particularly attracted by my double-barrelled gun with percussion locks. It was to them incomprehensible how a gun could be fired off which had neither flint nor steel to produce sparks to ignite the powder. In order to give ocular proof of my explanations, I shot a swallow flying by, which increased their amazement, as they thought that I had fired with ball. I left them in undisturbed possession of this opinion, which seemed to raise me in their estimation. The chief Tatars here are fond of field-sport, confining themselves, however, to the fashionable sport, which is with the falcon. Our host in this place had a falcon (it seemed to me to be *Falco lanarius:* it flew direct), which he let fly at a sparrow in our presence. The Tatars were surprised, also, at seeing me take snuff, and asked me what it was. I told them its name, and asked them to take a pinch, but none of them had resolution enough to try it.

"And now I think of an anecdote which was told me as a fact. When the Tatars and Kurds, in the year 1827, fell upon the German colony of Catharinenfeld (not far from Tiflis), and massacred or carried off all the inhabitants, it was the fate of one old man to be among the captives. The Kurd who had got possession of him had also, at the same time, appropriated a canister filled with snuff, with the use of which he was unacquainted. The old colonist, who took snuff with all his heart, had not

at first the courage to ask for a pinch; but, after he had become better acquainted with his master, he begged for the canister, and took a pinch, whereat the latter wondered, and laughed heartily. When the Kurd had returned home, he led his prisoner as a strange animal to his wives, and made him take snuff in their presence, which so amused them, that when the canister was exhausted, they bruised tobacco leaves to fill it for him, and in all respects treated him kindly; so that, in this instance, a useless, or, it might be even called, a bad habit, alleviated the old man's captivity, or even, perhaps, saved his life.

"When we were ready to depart, we asked what we had to pay. The Yus-Bassa stated the amount, which M. von Behaghel gave him. Immediately, several of the Tatars, who were standing round, went up to the Yus-Bassa, and spoke to him very warmly. The Yus-Bassa was embarrassed; and, coming to us just as we were about to mount our horses, humbly entreated us to take back the money. We were unwilling to do so, and observed that he had a right to it, and might keep it. But the other Tatars united their entreaties to his, and we were obliged to receive the money back. We had hitherto been riding over a sandy plain, but now the country became hilly and rocky; immense fragments of lava, heaped up in groups of various forms, gave shelter to the wolves and foxes, which are said to be here extremely numerous. We spent the night in a Tatar village named Arakhperi, where we were well treated, and our payment was received.

"The 26th of September, and consequently the third day of our journey, we arrived, about half past three o'clock in the afternoon, at the village of Kulpe, close to which the salt-mines are situate.

We were immediately conducted to the officer stationed here, an Armenian, holding the rank of lieutenant in the Russian service, and who commanded a few Russians, and some native soldiers called Servas, also in the Russian service: he also had a part in the superintendence of the mines. After reading our papers, which we had got from Aisas for this excursion, he welcomed us in a very friendly manner, adding that he would be happy to assist in forwarding our plans. He then led us into his dwelling: this was a round tower of two stories, each containing one room; the lower one was occupied by some soldiers. In order to get into the upper room, which was the officer's abode, it was necessary to climb a ladder, such as with us is used for mounting into a hayloft, and then through a square opening, which might be closed with a hatch: we had the luck to enter safely. The room had four irregularly-shaped quadrangular openings in the wall to admit light and air. The flat roof was so thin and weak, that when a few sparrows hopped about upon it, little pebbles and bits of mortar kept falling down. The officer was so obliging as to resign to us this chamber, and to seek lodging for himself elsewhere.

"Kulpe is a very large village. As there is here a great want of wood, the people are obliged to use dung for fuel: for this purpose they wet it, make it into large flat and round pieces, and dry it in the sun. They had it now heaped up round their houses, undergoing the drying process, and it gave their habitations a very singular appearance. The salt-mines (for these may be truly called mines, inasmuch as, under a very insignificant stratum of clay and gypsum, rock salt is come upon at once) are very productive. The hills from which the salt is taken extend about ten miles in circuit.

The salt is cut in large rectangular pieces, weighing from 80 to 120 pounds. Nearly 300 people are there daily employed. The inhabitants of the village are bound to cut the salt, and receive wages at the rate of one abas (equal to 80 copper copeks) for five pieces of salt. Both white and red salt are found here. For some years back, these mines have been let to an Armenian merchant of Erivan. Having seen the works, we set off on our return on the afternoon of the 27th of September, spent the night again in Arakhperi, and on the 28th arrived in the village of Tashburni, where we met with a cordial reception from Assu, the aga who had previously showed us so much attention.

"In order to testify our gratitude to him, I made him a present of some pipes of Riga clay, two fine white flints, and a piece of amadou, telling him that these things came from St. Petersburg. This was the only place in Russia of which he knew the name. The present seemed to gratify him. Early in the morning of the 29th of September we rode off, and towards evening arrived safely in our monastery of St. James."

CHAPTER XI.

Magnetic Observations.—Astronomical Labours.—Nomadic Habits of the Tatars.—Kurds.—Nestorians.—Wild Hogs.—Monastery of St. James.—The Plain of the Araxes.—Traces of the Deluge.—Tatar Villages.—Inhospitality of the Tatars.—Fanaticism.—The Base-line measured.—Return to Arguri.—Sheep's Milk.—Apricot Groves.—Native Dinner described.—The Archimandrite of St. James.—Persian Tyranny.

The night immediately following my return from the top of Ararat I employed partly in repeating my magnetic observations already mentioned, and partly in making experiments with the pendulum.

The declination of the magnetic needle from the meridian, which in Dorpat I had found to be 9° 1′, in Tiflis 3° 47′ west, proved to be on Ararat 4° 29′; the inclination of the magnetic needle, in Dorpat 70° 43′, in Tiflis 55° 33′, I found on Ararat, with the same instrument, to be 53° 6.′ For the pendulum experiments, which required a very firm point for the suspension of the apparatus, I had recourse to the wall of the monastery, which is built of regularly-cut stones of porous lava, and was admirably adapted to receive my sharp steel nails, which I brought with me for such purposes, without obliging me to resort to the joinings of the stones. This was particularly fortunate, for the weak beams in the apartments of the monastery were far from possessing the firmness requisite in making such experiments; and had I thought of erecting a regular pedestal for the purpose, I should have had to send thirty-five miles, to Echmiadzin or Erivan, for wood: as it was, I completed my arrangements with two nails, which have such a hold in the wall that they will resist the tooth of time for many a century.

These pendulum experiments employed me during a week for about an hour in the morning, evening, at midday, and midnight, and consequently left me, in the intervals, some time to devote to other and less important labours.

In the mean time, M. Fedorov, by means of a fine series of observations made with the Reichenbach theodolite, had determined the geographical position of the monastery, and from that, as well as from the measurements subsequently executed in the plain of the Araxes, he had deduced the geographical positions of Great and Little Ararat, of Alaghés, and of the village of Bayad, with a precision which left nothing to be desired, and was of

essential service to me in constructing the little map of that country. His labours in the monastery being concluded, M. Fedorov went down on the 2d of October into the plain of the Araxes, where, in the first place, he looked out for two points whence he might advantageously take his angles, and then for a place where he might measure a base-line. The former he found at once in two low hills, of which several here and there rise from the plain. The site for the base-line he selected very felicitously, in a place where the ground for a considerable distance was perfectly smooth and level.

He was accompanied by M. Schiemann and M. von Behaghel, as well as by a detachment of our party of Kossaks and soldiers. I also thought it necessary to send with him the feldyäger M. Schütz, in order to remove certain difficulties with respect to quarters, to which end also we had obtained a special order from the authorities of Erivan, addressed, in the Russian and Tatar languages, to the elders of the villages; for the plain of the Araxes in front of Ararat, while it contains some respectable Armenian monasteries and villages, is yet, for the most part, inhabited by tribes professing Mohammedanism, and who seize on every opportunity of manifesting their hatred and contempt of those who acknowledge the Christian faith. They are mostly Tatars, who have settled in villages, cultivate fields and gardens, and engage with predilection in the breeding of cattle and horses, but still are so far nomadic as to desert those plains during the summer months on account of the oppressive heat, to betake themselves to the country round the mountain fortress Maku, to the khan of which they were at one time tributary. This wandering still takes place, although a defined boundary-line, drawn from Ararat in a southeastern di-

rection to the Araxes, separates the Russian dominion, on which these people are settled, from the Persian, on which they sojourn in summer.

Besides these Tatars, there are also some Kurds who pitch their tents in the plain of the Araxes, but wholly in the nomadic and roving character; living in families more or less numerous, under dirty gray felt tents, and with large herds of cattle, they shift about, and occupy now one piece of land, now another. The Kurds have occupied from time immemorial the fruitful plains of ancient Mesopotamia, round the Euphrates and Tigris, their hiding-places being in the valleys of Taurus; yet there is nothing certain known of their origin, for they differ from the Turks, as well as from the Persians, in countenance and figure, as much as in character and mode of life. Drouville, who had opportunities of becoming well acquainted with them, is of opinion that they closely resemble the Bedweens, and is disposed to look upon them as the descendants of an Arab colony.* Although subject to the Persian sceptre, they do not belong to the sect of Ali, which has the upper hand in Persia, but to that of Omar, which prevails in Turkey. They are not ashamed to seek their fortune in Turkey, and not unfrequently they succeed, through their subtlety and warlike spirit, which lay open for them the path to the highest posts; for example, the Pasha of Bayazed was at that time a Kurd. This descent they always regard as honourable, and steadfastly retain the peculiar Kurdish costume.

If the Kurds are important in our eyes on account of their determined hostility to the Christian faith, they ought to be still more so in consequence

* Voyage en Perse, fait in 1812 et 1813, par Gaspar Drouville, Colonel de Cavalerie au service de S. M. l'Empereur de toutes les Russies, &c., Paris, 1825, tom. ii., p. 171.

of their close connexion with a most remarkable Christian community, which reaches to the earliest times of the diffusion of our faith. We here speak of the people known in ecclesiastical history as *Nestorians*, and whom the Tatars, Turks, and Armenians call *Yedsdíh*. This Christian sect dates its origin from the first half of the fifth century, when the Patriarch Nestorius, in Constantinople, in consequence of a religious controversy respecting the dignity of the Mother of God, was convicted of heresy by two synods, condemned, and deposed. His numerous adherents, however, were unwilling, as is generally the case, to be taught by these proceedings, but preferred to separate themselves completely from the Catholic Church; and as their bishops, too, were banished from the empire, the whole body fled to Persia, where they met with a friendly reception from their fellow-Christians, and whence they extended their creed and doctrines to Egypt, Syria, Arabia, India, Tatary, and even to China. In ancient Chaldæa, particularly, they obtained a firm footing; and even to the present day they make use, in their public worship, of the Chaldæo-Syrian language. At present, they are for the most part under the unrestrained sovereignty of the Kurds; have similar costume and usages with them, follow them readily in war, and fight valiantly for their oppressors; to whom, in time of peace also, they are obliged to give up the fruits of their industry. I have had myself no opportunity of seeing a Yedsdíh, as they do not dwell in the vicinity of Ararat; yet, in the eyes of Christians, their community is so interesting and important a spectacle, that I feel fully justified in here giving Drouville's description of them, in the work above referred to:

"The Nestorians are the remains of those Chris-

tians who once inhabited part of Arabia and Mesopotamia. Their language is the Chaldee, and their religious usages, which differ essentially from those of the Armenians, have a close resemblance to those of the Roman Catholics. They have no inclination to trade—another broad mark of distinction between them and the Armenians; but they are passionately attached to the profession of arms, and are the best warriors on foot whom the Kurds can find to defend their mountains. They are brave, hospitable, very social, and have a great respect for all Christian strangers. They are so ignorant, and, at the same time, so accustomed to be led, that they never perceive that they want nothing but the resolution to shake off the yoke which those robbers the Kurds have imposed on them.

"The religion of the Nestorians approaches closely, as has been observed, to that of the Roman Catholics. Although it has not the mass, yet it prescribes a similar spiritual office, and it gives the holy sacrament in both forms. But it has also adopted many superstitious practices; such, for example, as that no one can enter the church without undergoing, like the Mohammedans, much washing and purification; and, during prayer, the face must be turned towards Mekka. Their priests may marry, with the exception of the bishops: these must observe celibacy, and carefully abstain from all animal food. This religion imposes, generally speaking, great privations and restraints on its followers. Every Wednesday, Friday, and Sunday they fast, abstaining from meat, fish, eggs, butter, milk, and eating nothing but bread and fruits. Their great fast, which lasts nine weeks, is no less strict; so that it is not easy to comprehend how men whose lives are so active can submit to such strict and continual abstinence, and

without ever allowing their field labours to be interrupted by it.

"Their women are very active: in the ploughing and sowing seasons they spend a great part of the day in the field, and in the harvest-time they never leave it till everything is brought home. They are gentle in their manners—much more agreeable in appearance than the Armenian women, over whom they have great advantages, also, in regard to neatness and cleverness; for in all Asia their embroidery is looked upon as the best, and fetches a high price. A strange custom, probably derived from the rude ages of their Arab forefathers, is peculiar to them: they bore the right nostril, and insert a heavy gold ring in it, which hangs down to the chin. It would be useless to endeavour to put them out of conceit with this odd decoration, which custom has sanctioned, and without which they would conceive themselves wanting in visible respectability. These rings are at times so heavy that they tear the nostril through, in which case a new hole is bored above the former one.

"The priests of the Nestorians have no peculiar garb, and one occasionally meets a bishop in the costume of a Kurdish warrior; for they are clad, armed, and mounted like the latter. This is done to escape the notice of their persecutors, and also for the sake of being able, in case of necessity, to resist attacks. Among their flocks they enjoy a respect approaching veneration: when they enter a village, men, women, and children—all, in short, who can, try to get near them, to kiss their hand, or the hem of their garments; and the people with whom they lodge think themselves more honoured by that circumstance than if they entertained the King of Persia. The Kurdish chiefs affect to be civil to them, in order that they may better hold

the people in subjection. Yet it is manifest that the Nestorian clergy take these attentions amiss, and that they will not require to be pressed to preach revolt whenever it can be done with safety.

"Their patriarch, whom they call Kaliph, exercises an unlimited moral influence over the people. At his desire, the whole people would arm and follow him wherever he might lead. He is, after God, the object of their greatest veneration, for they hold him to be infallible; hence it may be inferred how punctiliously he is treated by the petty Kurdish chieftains, whom he hates from the bottom of his heart, notwithstanding the handsome presents which they make him. I was bent upon learning his sentiments, and, in spite of his reserve, he could not hide the profound humiliation which he felt at being obliged to bend his head beneath the despotism of these barbarians.

"These priests and bishops are all as ignorant as it is possible to be. They have scarcely the first notions of the principles of their religion, and follow merely a rude mummery, of which they are unable to give any account. They possess very ancient books, written in Chaldee; and though most of them can read those books, yet I am inclined to believe that they do not understand them. I have seen some of those MSS.: they were very coarse in appearance, and full of representations of the devil in all shapes. It is the fear of him, and not zealous faith, which makes them observe the precepts of their religion; for, from all the discourses which I have had with them on these matters, it was manifest that the fear of punishment, rather than the hope of reward, was the basis of their moral code. The Nestorians get from their priests a faint sketch of Paradise; but, on the other hand, a terrible picture of hell, which they are

taught to believe inevitable, on the least violation of the rules of religion."

Such is Drouville's account of them.

I had occupation for some days in St. James's, which retarded my going down into the plain of the Araxes. How it fared with my companions on their arrival and the first days of their residence there, may be learned from the following brief narrative, written by M. Schiemann :

"On the 29th of September, one of our Kossaks, who had been sent for hay into the Tatar village of Bayad, on the Chornaya-rechka (Blackwater), told us that a peasant of the village begged us to send him some powder and lead, that he might shoot for us some wild hogs, which were laying waste his rice-fields. I determined to go there myself. On the 30th I rode, in company with M. Schütz, and attended by two Kossaks, to the village, about ten miles distant from the monastery of St. James. We arrived there about noon. The Chornaya-rechka has very marshy banks, extending for miles in some places, and covered with a tall and almost impenetrable growth of reeds. Here the wild hogs, of a dirty, darkish yellow-gray colour, lie concealed in great numbers, issuing forth at night to the rice-fields of the Tatars, on which they commit terrible devastations. The inhabitants, therefore, as soon as the rice begins to ripen, watch the fields at night, having dogs with them, which they set upon the hogs. In this way the latter are often caught and torn to pieces in the fields.

"On the evening of the same day we made the villager conduct us to the rice-fields; we took with us one of our Kossaks from the shores of the Black Sea, who told us that he had often shot wild hogs. We had scarcely gone a quarter of a mile from the

village when we saw a sow with four young ones: we tried to creep upon them, but without success, our advance through the reeds making too much noise. A little farther on we found it necessary to cross an arm of the Chornaya-rechka. The water reached above the knee; nevertheless, we did not allow ourselves to be frightened by it, but waded through it at once, laughing at one another's wry faces, for the water was excessively cold, and there was no want of comic gestures. After we (that is, M. Schütz, myself, and the Kossak) were over, we looked about for our guide: there we saw him in a deliberating posture, still on the other side of the stream. On our calling to him to come over, he begged the Kossak to carry him across. We laughed at him; and the Kossak, in reply to him, said, 'The gentlemen have come through the water, why should not you do the same.' The poor man was thus obliged to make up his mind to march through the water on his own legs. We sat a long hour on the watch, and heard the hogs frequently about us, but could not get sight of one, as it was by this time rather dark.

"Having heard a shot, which we conjectured was fired by the Kossak, we started on our return, for we were stiff with cold, being wet through. The Kossak, whom we frequently called, came to us after some time: he had shot a hog. The wild swine have beaten broad paths through the reeds, by which they go to the rice-fields. On one of these the Kossak, daringly enough, took his post, and had the luck to get a shot. The next morning the hog was dragged into the village with a horse: it was of goodly size, and must have weighed at least 280 pounds, for a pack-ox on which it was placed, in order to carry it to the village, sank under the load, and a good pack-ox will easily bear

the above-mentioned weight. While the Kossak was employed in skinning the hog, a number of Tatars gathered round him, one begging for the skin, another for the lard, to serve as ointment for wounds. The Kossak consented to give them the lard, provided they would take it in their fingers, which none of them would venture to do. They split a piece of wood, so as to make a kind of rude forceps to hold the much-prized ointment, and were at length allowed to have their way, after the Kossak had teased them to his heart's content, threatening at one time to anoint them copiously with the fat of the unclean beast, and at another, asking them why, if they really wanted the lard, they did not shoot the hog themselves. The flesh being packed on two oxen, we reached the monastery in the evening with our spoil. As it was necessary for M. Fedorov to go down into the plain of the Araxes for the purpose of measuring Ararat trigonometrically, he rode on the 2d of October to the village of Bayad, where he fixed his headquarters: M. von Behaghel, M. Schütz, and myself accompanied him.

"After spending two days in Bayad we left it, and rode two miles farther, to the Tatar village called Syrbaghan, near which was an isolated hill, selected by M. Fedorov as a station for his measurement. On our arrival in the village, our guide led us to the residence of the Yus-Bassa, that he might assign us good quarters. He was not at home, nor was there a single adult male in the village: the women were left alone in it; and they would not, on any account, allow us to stay there, but assailed us violently, pelting us with stones and dung from the roofs of the houses, and screaming all the time. At first we laughed at them, and were amused at their rage; but as they grew more da-

ring on seeing that we only ridiculed them, and as some of us were actually struck by their missiles, we sent a couple of Kossaks upon the roof, who soon dispersed the fair assailants with their nogaiks, or Kossak whips. Now the tumult began in right earnest, for other women rushed forward to assist their friends in turning us out, and our whips alone saved us from being overwhelmed. As we saw that there was no possibility of our attaining our object, we sent forward M. Schütz, with a Kossak, to a village half a mile farther on, in order to procure quarters for us there, if it were possible. This village, however, was, with the exception of two or three sarais, or dwellings, all in ruins. M. Schütz was more lucky in meeting with some khan's secretary, to whom he showed our papers, whereupon the secretary, having read them, decided on riding back to the first village, where he persuaded the Amazons to give us a lodging, with some bread and milk. This affair altogether consumed three hours.

"That which determined these women to refuse us lodging so obstinately and so angrily was probably the Kossak's horse in our train, which was laden with the hog's flesh, and covered with the animal's skin. Pork under their roofs would have made their houses and themselves, as Mohammedans, unclean; hence their anger. A few hours later, after we had taken possession of the dwelling assigned to us, there came there three Tatars, one of whom, as it afterward appeared, was the owner of the abode. These Tatars, turn about, kept watch in the court day and night, in order that they might be at hand, as we were able to discover from what fell from them, in case we should offer violence to their women. In fact, they believed, though they did not think fit to say so, that this was the sole object of our visit.

"In the whole village there were no more than four men; the rest were gone to some Persian khans, to assist them in their field labours throughout the summer, and then to return to their homes in winter. In the mean time, all the work of the village devolved on these four men and the women.

"This village had so little tillage around it, that it could not even supply us with barley for our horses. On the 9th of October I set off again on my return to the monastery, for here I could find no occupation in my department, the birds being so shy at this late season, that, after giving myself a great deal of trouble, I could kill nothing but a pair of large water-hens. In this instance, however, I was as unfortunate as I had been twice before; for, having taken off the birds' skins, I left them at night near my bed to dry, but found them next morning torn to pieces, probably by cats, which thought to get a dainty morsel; but they cannot have gained much by their lickerishness, for the insides of the skins were besmeared with arsenical soap."

While I was staying behind in the monastery with the Deacon Abovian and M. Hehn, I receiv ed from the former, for the first time, positive in formation respecting the name of our place of residence. In Echmiadzin, the little monastery on the declivity of Ararat was always named St. James; to my great astonishment, however, the old Archimandrite Karapet explained to me, a few days after our arrival, that it was called St. Gregory, and that St. James was the name of the little chapel, built about two thousand feet higher, upon the edge of the great glen, but at that time deserted—the same which I have described more circumstantially in my account of my first excursion to the sum-

mit, and near which are the holy wells, &c. Although it struck me as remarkable that there should be here a second monastery named after St. Gregory—for in the plain of the Araxes stands the great head monastery of St. Gregory, or Khorvirab, where the martyr suffered—yet I could not help supposing that the aged inhabitant of the monastery in question, an archimandrite of his rank, ought to know best how his benefice was named, and consequently, in some letters and papers which I wrote describing the place of my abode, I called the monastery St. Gregory on Ararat.

It was at the period already mentioned, towards the close of my residence there, that the deacon informed me that, in looking about for inscriptions in compliance with my wish, he had found in the interior of the little monastery chapel a stone in the wall with the following inscription in Armenian: "From the grace of God, I, Mekhitar, and my wife Tamar, bequeath all our money to this monastery of St. James, and in return, the holy brethren promise, in memory of us and of our posterity, to make mention of us four times a year in the mass." To this was added 737 for the year, in Armenian characters; for the Armenians, from the most ancient times, employed till very recently certain letters of their alphabet as ciphers. This date shows that the above-mentioned monument was executed in the year 737 of the Armenian era, which begins with one of the greater reforms of the Church, 551 years after the commencement of the Christian era, and consequently must be referred to the year 1288 A.D. It follows that in Echmiadzin they were correctly informed respecting the name of the monastery, and that our worthy old man, in the course of his meditations, had completely lost sight of the reality.

The day before I intended following M. Fedorov in the plain of the Araxes, there arose all at once an unusual bustle in our quiet monastery. I found the archimandrite, his two servants, a few peasants from the neighbourhood, the deacon, and the two soldiers who remained behind with me, all collected together with anxiety and curiosity in their looks: nor was it long before I shared their feelings; for I saw five wolves descend as if they dropped down the steep slopes of Ararat, and fifty yards from the wall of the monastery drive off a calf from the small herd of cattle; but, as men pursued them with loud cries, they soon made an end of the affair by tearing up the carcass of the poor animal, and, leaving it in this condition for the rightful owner, they continued their course unmolested to the plain.

On the 10th of October, in the forenoon, I set off from St. James's, in company with the deacon and one Kossak, to make an excursion in the plain of the Araxes. Immediately behind Arguri we turned to the right, that is, eastward, through numerous vineyards and plantations of apricots, among which were also some pshat or eleagnus trees, and soon after we left the domain of the volcanic ruins, which lie spread over the entire slope of Ararat, from the limits of perpetual snow to St. James's, and below Arguri. The soil now consisted of loamy earth mixed with small pebbles and gravel. In this soil the Arguri rivulet has cut itself a deep bed, yet we found it at this time of the year quite dry, for even at St. James's it had hardly water enough for our horses; and yet in spring it often swells to such a degree as to fill the water-way, six fathoms wide and three deep, completely. It then rolls down large masses of rock one over the other, and not unfrequently rushes on so suddenly,

that animals which happen to be in the bed of the stream have no time to save themselves, and every year the old archimandrite loses some calves from his small herd in this way.

As soon as we reach the foot, properly so called, of Ararat, and arrive in the plain which is intersected by the stream already described, called the Karasu (Blackwater), we find on the ground, which is but scantily covered with vegetation, fragments of lava from Ararat, which are smaller, and of a more porous, lighter nature the lower down we go. The farther we advance into the plain, the finer does this gravel become, until at last it resembles coarse but exceedingly light sand. On the Blackwater, even, it is hard to find a single stone. This great uniformity in the distribution of the stony masses over the declivity of Ararat, in proportion to their size and weight, must have had a special ground. Above, in the vicinity of the snow-limits, the masses of the densest, hardest lava, from which the mineralogist's hammer can with difficulty break off a piece, are nearly of the size of a house. Lower down the same kind of rock occurs in smaller pieces, six or eight feet in diameter; and at St. James's these are intermingled with lavas of a lighter kind, and in fragments of less size. Below Arguri there is only gravel to be found, of a light, pumice-like character, which passes through many gradations into mere sand. All this is not the work of accident. It has evidently been brought about by a mechanical force, acting according to determinate laws; and what was this force but the floods, which 4000 years ago were poured forth, when "the waters prevailed, and were increased greatly upon the earth; and all the high hills that were under the whole heavens were covered;" but then, again, "the fountains of the deep and the windows

of heaven were stopped, and the rain from heaven was restrained, and the waters returned from off the earth continually."

If we consider, on the simple principles of hydrostatics, the operation of these waves rising and falling on the sides of a mountain, covered with masses of various size and gravity, it will be easily understood that none but the largest and the heaviest rocks could remain in their original situation · the smaller ones, tossed up and down by the waves, must descend more or less, yet need not reach the bottom, because all bodies are much lighter in water than in air, and, consequently, do not fall in the fluid with their whole weight. The deeper the surface of the water sank, the greater were the number of the mountain tops which rose above it; the weaker, therefore, became its waves, the calmer its surface, the less the moving power exerted against the fragments of rock, and therefore only the lighter and smaller pieces could be moved from their place and carried down the declivity; and, finally, in the valley itself arrived none but the most fragile and lightest fragments, which being driven up and down, became converted into sand. At the same time, whatever earthy particles were on the declivities, all came together below, and beneath the falling and gradually calming waters, formed that remarkably level and horizontal plain, in which we now indubitably recognise, round the Araxes, a speaking testimonial that the whole district was once under water. If to this be added what I have already said, when describing my entrance into the plain of the Araxes, respecting the character of the drains which, under the name of the Blackwater, intersect that country, we shall then have a physical proof of the correctness of the historical narrative of the Flood which cannot be

easily flung aside, but will afford an additional assurance that a great truth, derived from pure sources, can be ocularly demonstrated even after thousands of years, notwithstanding what skepticism and incredulity may say upon the subject.

In going down into the plain, I chanced to turn my eyes back upon Ararat, and saw a magnificent spectacle. There had been cloudy weather for some days back, and although it had not rained at St. James's nor in the plain, yet snow had fallen on the mountains. It now lay on the region not usually covered with snow, far below the snow-limits, only as a light, transparent veil, through which might be distinctly seen the shape of every hollow and declivity: on the Little Ararat could be distinguished the beautiful tracing of the furrows, which descended from the summit like the folds of a veil.

We had left St. James's at about ten o'clock in the forenoon, and we reached the Tatar village of Syrbaghan, on the Blackwater, about four o'clock. The men of this village capable of labour, who live during the summer on the Persian territory, and give their service chiefly to the Khan of Maku, were already returned home, and my companions were on a tolerably good footing with them, so that we could, without fear or apprehension, each attend to his own occupation. These Tatar villages present to the eyes of the traveller a singular contrast of amenity and desolation. They are ornamented with plantations of tall trees, which from a distance in the wide plain have a very agreeable appearance. The trees are generally willows, Italian poplars, mulberry, apricot, and the pshat or eleagnus trees, the latter with its date-like, edible fruit. The Blackwater, or some branch of it, runs through the village; numerous herds of cattle, droves of

horses, and flocks of sheep wander over the wide steppe, and immense flights of migratory birds wheel in circles through the air. Wild geese and ducks I saw hovering about in flocks of many thousands, and settling down on the steppe for a few hours, to rest after their long flight over Caucasus, and then to hasten over Ararat farther southward.

On the other hand, the look of the human dwellings is cheerless in the extreme. There you see no neat fence nor decorative palisade, no white wall shining from afar, no red-tiled roof nor well-trimmed thatch; there is nothing to be seen but dusky walls, built of grayish mud, nearly of the same colour as the dry ground; there is no such thing as a pretty row of windows towards the street, no friendly, welcoming open door: everything is close and shut up within itself, and the stranger can hardly tell whereabouts the wall will open to let him into the interior. Generally speaking, in these countries, so deficient in wood and stone, this is the mode of building usual with the lower orders among the Armenians and Georgians as well as others, and even in the suburbs of Tiflis. The streets, or, rather, alleys of these villages are formed partly by the windowless and doorless sides of the houses, and partly by a low wall, which encloses every court and separates it from the other; but all is of mud, the gray colour of which, and its parched dryness in summer, make no agreeable impression on the beholder. The roof, made of clay and plaster, is flat and level, and serves the Tatars as a second story, the ceiling of which, indeed, is the canopy of heaven. The entrance to the house is in the court, where there is a small door, through which it is generally impossible to enter without stooping, and having passed that, you find yourself at once in the portion of the house

intended for the horses and other domestic animals. From this a short flight of steps leads a few feet higher to a raised floor, separated only by a balustrade, and there the family go through the whole circle of their domestic economy. Some of the larger houses have also, on the side towards the court, a projection of the roof, with a sort of gallery under it, where one can sit in the open air and yet in the shade. In a corner is a fireplace with a chimney leading through the roof, while one or two slender openings in the wall give admission to a little light.

This was, at least, exactly the plan of the houses which were assigned to us for lodging in three Tatar villages, and the rest could not be very different from them, to judge from the outside; for as to becoming acquainted with the inside, that was forbidden us by the inhospitality of the Tatars, whose gross dissimulation, and artifice besides, in their dealings with us, were to me extremely repulsive. The men were prudent enough, however, after looking at our papers and our military escort, not to refuse openly to receive us, as the women had at first done; on the contrary, they talked a great deal about the pleasure and satisfaction that they would feel in serving us, declaring that we should want for nothing; and yet they began the very same day to refuse us the commonest and most necessary things, at first on the most trivial pretences, as that they forgot it or had none laid by, but afterward they said that the master of the house and his people had gone out and could not be found. After I had bought a sheep from our host, as well as butter, milk, and bread from him every day for good payment, himself dictating the terms, I asked him the last evening to let us have some milk, and he sent, as if for mockery, a small

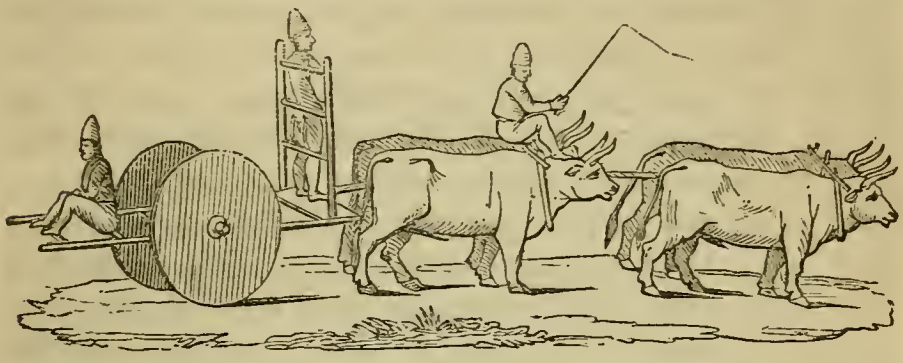
cupful. I begged for more, and obtained a mere trifle. The same evening I ordered the usual quantity of milk, to have it in readiness for the following morning, but could not get it, and yet the man to whom I applied had sixty-eight cows in his courtyard, and many hundred sheep on the steppe.

Our host in Syrbaghan asked me three or four times how much longer I would stay, although I had been there but a few days, and he even begged of me to remove to another house, where, he assured me, I should be much better accommodated. At last he tried to make an impression upon me by sending his cousin, who had just returned from the army, to repeat his request in officer's uniform. Through the latter, however, I told him not to make himself uneasy, as we had not the least desire to stay a day longer with him than necessity required; that we should go when our business was finished, and not an hour sooner, however importunate he might be. After that he left me in peace, and, indeed, gave himself no farther trouble about us; the small quantity of provisions that we still required we were obliged to seek elsewhere in the village.

This behaviour is partly ascribable to the novelty of the intercourse, for Tatars have repeatedly shown great friendliness and hospitality to travellers, as I have myself experienced in the most convincing manner during a month's residence with the amiable Tatars of the Crimea. The Tatars of the two villages near Ararat, in which I halted, belonged also to the rudest of their tribes, or the Chubankerah, as they are called, that is, the wandering herdsmen. On the other hand, the village of Bayad, in which M. Fedorov first took up his abode, is inhabited by Tatars, who, with fixed habitations, have much more civilized manners. The fanaticism of these people, and their religious hatred

of Christianity went so far, that, having borrowed from our soldiers some iron pots for cooking, they not only washed them — a very significant proceeding among the Tatars—but even put them into the fire and made them red hot; because a true Moslem cannot eat out of the same vessel as a Christian without becoming, in a religious sense, unclean.

I was amused in looking at the common carts



used by these Tatars, which they load to a great height with hay and other produce of the fields, and then draw in the manner here represented. The wheels are complete disks, fixed to the axle, which consequently turns with them. A light iron streak protects their well-rounded and very narrow circumference. The day after my arrival, each of us set to work at his own occupation at an early hour. The feldyäger Schutz rode to St. James's with a Kossak, to look after provisions; M. von Behaghel went on an excursion with the deacon to the Red Mountains towards the Gokchai, to the Kegartha-Wank, or monastery of the Holy Spear, and to Erivan. M. Fedorov led me a short distance from Syrbaghan, to the place which he had very judiciously selected for marking out and measuring the trigonometrical base-line, and then went himsslf to the stations fixed on for taking the angles, at which he had been labouring most zealously

ever since his first arrival in the place; I had taken upon myself the measurement of the base-line, and spent upon it five whole days, for it was a mile long, and my only assistant was a Kossak private; besides, I was obliged to return to the village every night, and in doing so to take all my apparatus with me.

The soil in this place is a mixture of loam, alluvial earth, and the finest sand: a thin crust of salt crystallizes on its surface in patches of considerable extent, which may be recognised from a distance by their glimmering whiteness. According to an analysis which I owe to Professor Göbel, this salt consists of 84·6 parts of common salt, and 14·5 parts of Glauber's salt.* Here, again, is a new and clearly-expressed reason for assuming that this tract was once covered by the sea. A scanty herbage and a few bushes barely cover the ground. The neighbourhood of the Blackwater and its arms is distinguished by a tall and impenetrable forest of reeds. Near the villages, these marshy flats are chiefly devoted to the cultivation of rice, which in such situations may be easily irrigated. This is, of course, a capital locality for the increase of the Tatar's arch-enemy, the wild hog, which finds in the reedy thickets a secure and cool hiding-place, while at no great distance it can at its ease batten on the rice-fields; for the Tatar carries his religious prejudices respecting the uncleanness of this animal so far as never to think of chasing it, because, if he kills the brute, he can have nothing to do with carrying it away, and he prefers letting his plantations be laid waste to giving the neighbouring Christians the right of looking down upon Mohammedan prejudices, and of engaging in the chase of these animals for the benefit of all.

* Schweigger-Seidel, Journal für Chemie und Physik, 1830, pt. 12.

The astronomical labours of M. Fedorov rendered it necessary for us to change our quarters to a village called Prehóh, nearer to the base-line, where, however, we spent only two or three days. On the 18th of October, I made, every two hours from morning till evening, barometrical observations on the base-line, while M. von Behaghel, who had returned a few days before me to St. James's, made contemporaneous observations there, which it was necessary to do, in order to connect the barometrical measurement of the summit with that of the base-line, and to be able to compare the result with the geometrical measurement.

I was the last of our party who left the plain, and on the 19th of October I went back to St. James's, the deacon accompanying me. Near the plantations of Arguri we met with a great flock of sheep, and, notwithstanding the advanced season of the year, we suffered exceedingly from the heat; the deacon proposed to me to allay my thirst, for once, with sheep's milk; the obliging shepherd had a little store of it ready for himself, and he liberally gave us as much of it as we desired. I found it an excellent cooling drink, which may be taken even in the greatest heat without risk, and, at the same time, with an extremely agreeable flavour. It was truly delightful at this sultry season, at the end of autumn, to seek and to be able to find a cool shade beneath the luxuriant foliage of trees, and particularly in the magnificent groves of apricot-trees on the right-hand side of the road.

Thus, at length, I reached Arguri in high spirits, and there spent a little time in visiting the priest of the village, and trying to become better acquainted with him. Like all the secular clergy of Armenia, he was originally a layman, and became a priest because he had made a vow some-

time or other to enter the priesthood; but, like all his fellows, he was without either preparatory or subsequent education, and, consequently, he was treated with but little respect by the community, and exercised but little influence; besides, he was very ill provided with means, and, consequently (which was, after all, the most agreeable circumstance), he was extremely simple in his housekeeping, and free from pretension in his demeanour. To me he was extremely friendly, manifested much joy at my entering his dwelling, and prevailed on me to accept his pressing invitation to take share of his dinner. To this I was farther induced by a healthy appetite, and I very soon grew intimate with all the peculiarities of the Armenian mode of eating, as I have already described them, and in which, after all, there is nothing hard to learn, the fashions of the land being little more than the simple dictates of nature. Our table, that is, the round board, or a low prop like a music-stool, was laid, to say nothing of the ever-abundant losh or thin bread, with the following dishes: salmon-trout from the Gokchai, salted and well washed; cold mutton cut in pieces; hard-boiled eggs taken from the shells and cut in halves; curdled milk; cream cheese, and the fruit of the arbutus. Each of these things, with the exception of the last, was served up on a separate metal plate, and all these plates stood on a large tray of tinned copper, which occupied nearly the whole table. Every one ate whatever he liked, going at his discretion from dish to dish, but all with his fingers: a can of gold-coloured wine from the vineyard at Arguri, and Noah's wine in great purity, washed down the cheerful meal. With a hearty squeeze of the hand I parted from the good-natured man, who, in truth, is not to be blamed if his flock have

not an enlightened pastor, and would, probably, have struggled hard to be higher and better, if the way had been but shown to him.

I soon found myself within view of the dear little monastery to which, ere long, I was about to bid farewell. Whether it was a like presentiment of the inevitable parting which induced the venerable archimandrite to come to meet me on the way, or whether his daily walk to the burial-ground occasioned our meeting accidentally, I know not; suffice it to say, the old man met me at a little distance from the monastery, and expressed, through his respectful and dignified gestures and deportment, in his Oriental salutation, so much true delight at seeing me again, so much pure benevolence, that I could not help feeling surprised how one who had grown old in the midst of privation and affliction should have felt or given expression to so much emotion. In fact, for many years back, the grave was the chief object of his wishes. In a poor monastery, high on the steep sides of the lofty Ararat, completely separated from what may be called in Armenia the civilized world, attended by only two servants to look after his household and his little stock of cattle, the Archimandrite of St. James's might still have led a happy life in the edifying contemplation of God's works and providence, and might have enjoyed an enviable lot, if, by resigning riches and worldly greatness, he could but have escaped the grasping selfishness and covetousness of Persian subordinates, who extended their arbitrary levy of contributions even to the poor monastery on the heights of Ararat, carried off the cattle reared with so much care, and did not scruple even to maltreat personally the venerable old man.

That general place of rest to which he had at-

tended so many of his brethren was, consequently, long since, even in life, an object of desire to him; and since he could not hope that after his death any one would take the trouble to bestow pains on his tomb, he made it his amusement to do it himself: for years he was in the habit of working at his own grave on the pretty hill not far from St. James's, and on which is the burial-ground of Arguri. After having dug the grave, he was employed in lining it neatly with stones; and daily I saw the old man, in his worn-out garments, the trowel and some mortar in his hands, go off with a contented heart, and there add stone to stone as long as his weak arm could endure the labour. I have seen him not unfrequently sitting on one of the stones asleep, perhaps enjoying an agreeable foretaste of the peace soon to come, and subject to no farther disturbance. There was something amiable in the flush of childish pride on the old man's countenance at the sight of the great tombstone which he got made by a stone-cutter, and covered with an Armenian inscription—the only sign of pleasure felt in perishable things, if a tombstone may be so called—which escaped the Archimandrite Karapet in the whole course of our acquaintance with him.

CHAPTER XII.

Excursion to Bayazed.—To Little Ararat.—Character of the Country.—Ascent of the Mountain.—The Summit reached.—Its Appearance.—Height.—Volcanic Glass.—Supposed Tombs on Little Ararat.—Inscriptions.—Attempts to decipher them.—Stepan Melik's Account of them.—Rapid Descent.—Magnetic Rocks.—Their Analysis.—Preparations for Departure.—Erivan.—Its Bazar.—Kanakir.—Pambak.—Quarantine at Gerger.—Lori.

The day after my return to the monastery I sent away four Kossaks whom we had received from Erivan and wanted no longer, and on the 21st of October my companions collectively, together with the feldyäger, the deacon, one of the Kossaks from Tiflis who had remained with us, and a guide from Arguri, made a little excursion to Bayazed, twenty-four miles from St. James's, to the south of Ararat, partly for amusement, and partly in order to allow M. von Behaghel an opportunity of becoming acquainted with the western and southern foot of Ararat. Some peasants of Arguri had spoken to me respecting the extensive ruins of the monastery of St. Aruthion, northeastward from Bayazed, in such a way that I could not help conjecturing the probability of ruins of much more ancient times being found there, and I hoped to derive some information on this point from my friends' excursion. I was hindered from joining in it myself partly by a slight indisposition, and partly by my preparations for our speedy departure. They found the town, however, and the country around, too deeply marked with the traces of the recent campaigns to be able to venture securely on distant excursions, and therefore were obliged to confine their visit to the town.

On the 26th of October, when we were all again met together in St. James's, we determined, the weather appearing to be favourable, on ascending Little Ararat, as they told us of flat stones to be found on its summit, with inscriptions which none of the travellers who had gone there had been able to decipher. M. von Behaghel, M. Schiemann, the deacon, and the feldyäger Schütz joined this little expedition, to which I added one Kossak and the soldier Chalpanof. We went on foot to Arguri: there we found five saddle horses and a pack horse, which had been ordered; two Armenians, Sahák, who had accompanied me on a former occasion, and his brother Hako, served us as guides. From Arguri, which we left at half past three, we directed our course southeastward, and then, in order to reach the foot of Little Ararat, we were obliged to cross over about six ridges, all descending from Great Ararat, and having for their foundation nothing but masses of lava of the less compact kinds, partly in its original position, partly broken to pieces. In many places it appears in precipices and abrupt cliffs, considerable heights intercept the horizon, and it seems to the traveller as if he were at the beginning of an extensive system of mountains. If the soil bore trees, although only in single groups, the prettiest landscapes in the world would be here.

About half past six we reached, by moonlight, the northern foot of Little Ararat, at a place where there stands a little birch wood about a mile in circuit, but with trees not above 10 feet high, and of very irregular growth. After unpacking our arms, instruments, utensils, and so forth, we had nothing to do but to gather dry wood, with which we soon kindled a blazing fire. The flames played in the clear, calm air, amusing us, and moreover warming

us, particularly during the night, for every one sought out a snug place near it, where, with dry leaves and warm clothing, he contrived to make himself a comfortable bed. All the firearms that we had were loaded, and placed beside us in readiness; for though, in general, since the presence of the Russian army, the predatory hordes had not ventured to quit their distant hiding-places and show themselves in this country, yet we were here on the most dangerous of the passes out of Persia, on the even grassy ridges which join together Great and Little Ararat.

Before we lay down to rest we cooked ourselves a good supper, which the severe cold rendered particularly necessary, and for which we had brought with us water from the brook at Arguri in a great wine skin, as we were told that in this direction there was no good spring to be met with. During the night the cold increased so much, that in the morning the water in the skin was partly frozen. In the course of the night, when I rose to inspect the little encampment, I observed with grief that the sky, hitherto clear and calm, began to be covered with suspicious-looking clouds, which were mounting behind both Ararats, and threatened my journey to the summit with a disagreeable issue.

On the morning of the 27th (8th of November), about seven o'clock, after we had tasted something, we all set off, with the exception of the Kossak and the Armenian Sahák, who stayed behind with our things, and to whom we particularly recommended that they would not let themselves be seen out of the wood. I was soon enabled to convince myself, by ocular proof, that Little Ararat also is of volcanic origin, since from its foot to the summit there was nothing to be seen but masses of volcanic rock, varying in degrees of hardness, colour, and external qual-

ities. But the lighter and more friable kinds appeared to predominate, for here is to be found spread over the mountain, in deeper strata the lower down we go, that coarse, light lava-sand which I have already mentioned; and now also it was seen that the streaks running down from the summit, which gives this mountain, from a great distance, a very peculiar and pretty appearance, were real furrows in the yielding soil, arising probably from the melting of the snow in the spring, and, from the same cause, either increasing in width or occasionally changing their direction.

The northwestern slope of the mountain, on which we were climbing, is less steep, at least in its upper half, than the eastern; yet it was steep enough to make our progress exceedingly laborious, to which was to be added the circumstance that it was impossible to get firm footing on the friable or sandy soil, so that it was almost always necessary to make three steps in order to advance one. Nevertheless, the ascent in this way was infinitely easier than if the declivity were covered with ice, because in that case no progress could be effected without cutting steps, and, on account of the greater steepness, would have been attended with much more danger than on the icy head of Great Ararat. Farther on towards the summit, the tracts of sand seemed to be confined to the hollows; bare, sharp rocks grew more frequent and prevailed around us. We climbed up one of these rocky ridges, and came to a great peak of rock, shooting up 40 or 50 feet above the ground. It may be seen from the plain of the Araxes, whence it appears an ordinary stone of middling size; in our sketch, also, it may be easily discerned close to the summit. From that place a narrow ridge, running tolerably straight, and with precipitous declivities

on both sides, leads to the top; its edge is so narrow that we could cross it only one after the other, and the west wind just rising strong and piercing cold, made the passage over a little alarming, for in spite of woollen gloves the fingers froze, and without a good cloak I should never have held out; consequently, I was the more astonished at the vigorous young soldier Chalpanof, who here too, as in ascending Ararat, was dressed in his uniform, and followed us contentedly without cloak or glove.

About eleven o'clock we reached the summit; but the weather spoiled our pleasure. Snow fell, accompanied by a cold, humid west wind; the whole sky was thickly covered, so that we could not even discern the place of the sun; and besides, a thick mist completely enveloped the height whereon we stood, and thus prevented my getting a general view of the country, from which I had promised myself much gratification. I found the shape of the summit to be just as it had appeared from the top of Great Ararat, that is to say, closely resembling the truncated end of a quadrangular pyramid, an irregular four-sided surface of perhaps 150 paces in the square, but covered, especially towards the edges, with several great rocky eminences at least 50 feet in height. On the highest of them, and consequently on the most elevated point of Little Ararat, I observed my barometer: it showed 17½ French inches, with the thermometer at 11½° Fahr. below the freezing point. M. Fedorov had the goodness to observe in St. James's another barometer from hour to hour, and thus the perpendicular height of Little Ararat is found to be 6672 feet above the monastery, 13,000 feet above the sea, and 4203 feet less than that of Great Ararat.

While engaged in the close examination of the

rocks on the summit, I found, on a mass of friable, yellowish gray-brown lava, some volcanic glass, partly in the stone itself, partly lying on it, having fallen in a fluid state in drops; it was translucid, shining, and of a brownish green, exactly like common bottle glass, only not so strong: a very decisive proof, not only of the volcanic origin of the whole mountain, but also that the subterranean flames, rushing out from the top of the cone, were able to melt the stones that had been thrown up. My colleague, Professor Göbel, had the goodness to make a chemical analysis of this glass, and found that it contains

Silicious earth - - - -	63·25
Aluminous earth - - - -	29·25
Lime - - - -	3·50
Protoxide of iron - - - -	2·80
Natron - - - -	1·00
Traces of oxide of manganese, and loss	0·20
	100·00

This analysis confirms the supposition that the volcanic masses have for the most part proceeded from the feldspath rocks.

As the thick veil covering the heavens was drawn aside for an instant in the direction of Great Ararat, I again saw on the southeastern side of this mountain the conical hills which had caught my attention on its summit on account of their regularly-pointed forms, and on two of them I observed most distinctly, exactly on the top, a hollow like the remains of a crater, but now covered, as well as I could discern, with vegetation.

The tombs, as they are called, on the summit, are to be found on various parts of it, wherever, between the large heaps of rock, the ground is soft and level. They had, generally speaking, all the

appearance of Mohammedan graves, being strings of stones about the size of a man's head, of the lava found there, and arranged in rings three feet in diameter at the utmost. Of such rings there were many to be seen; but there was only one larger than the rest, which also had another distinction, namely, two obliquely upright flat stones, of nearly equal size, about two feet and a half long, one foot broad, irregular at the edge, and with the surface either very roughly cut, or not cut at all, but exhibiting the natural split. The stone was the yellow-brown lava strewn over the summit, and which is a porphyry changed by fire. On these stones were Tatar inscriptions in the Arabic character. They were very slightly and superficially cut, but of age or the destructive hand of time they bore not the least trace; there was not even the stain of a lichen on them, though that was to be seen on many of the rocks lying about.

The deacon made as exact a copy as possible of these two inscriptions, and I submitted them to two men at Tiflis, thoroughly acquainted with the Oriental languages—the State-councillor Vlangáli and Major Abbas Kuli, son of the Khan of Karabag, both employed in the diplomatic department by his excellency Count Paskevich. According to them, only a part of the two copies brought with us was legible and intelligible; the reason of which is, that the Tatar language is sometimes written without points, as they are called, that is to say, without vowels, as was the case in this instance, and also that the original inscriptions, as well as the copy, which was made in a snowstorm, in severe cold and with frozen fingers, probably contained many inaccuracies. On one of the slabs could be deciphered, at the beginning, the word Arsalan, the name of a family ruling in Persia in

the sixth century, but also often met with nowadays in Persia among private people; and lower down were the words, "Mahmud of Maku has written it."

On the other slab, part of which also was unintelligible, the following sentences were made out: "My God, thy grace be upon Mohammed"—"The maker of this tomb has written it in the month Shawal of the year 650." As this date is founded on the reckoning of the Turks, it corresponds to the year 1292 of the Christian era. But that that stone could not boast of being five centuries and a half old was manifest enough, without consulting the inscription. It was not of a kind capable of withstanding, for such a length of time, the weather and action of the atmosphere, and least of all could the rings of arranged stones have done so, which yet lay as regularly in order, and on as smooth a piece of ground, as if they had been placed there only a few months, or even days before; I therefore adopt, not unwillingly, the explanation given by Stepan Melik, the village chief of Arguri, who maintains that these slabs with inscriptions are no tombstones, but were set up there eight years before, as he well remembered, by command of the Persian sardar, who had observed that the strangers had in various places erected stones with inscriptions, and seemed, from the zeal with which they sought after such monuments, to attach great value to them. Melik plainly intimated also that there was possibly some irony in this proceeding of the sardar.

Had the weather not been so dreadfully bad, I should certainly have tried to ascend the mountain once more, with spade and pickaxe, to excavate and examine the ground where these stones lay, although, judging from its outward appearance,

there was no reason to suppose that the soil had ever been turned up, or, indeed, that it was possible to turn it up or dig it to any depth; and, moreover, the carrying of a corpse up to the top of this mountain would be a task, the actual achievement of which would require, at least to one who had experienced how hard it was for the living man to ascend it, to be proved by arguments more conclusive than the stones and inscriptions above mentioned.

It was Sunday, and the place where we were assembled for our Sabbath devotions was not unworthy of the occasion. Under the vault of heaven, near the summit of Great Ararat, encircled by wild rocks, in a storm of wind and snow, we united in laying before the throne of God the offering of our heartfelt thankfulness, and in meditating, with thousands of our fellow-Christians, on the Gospel of the day.

About twelve o'clock we commenced our journey down, and as soon as we had turned our backs on the dangerous rocky region, every one hastened to descend by the shortest way. The Armenian peasant let himself slide down, riding on his staff, in one of the deep furrows which run down from the top of the mountain, and are filled with the fine and easily agitated lava-sand. About two o'clock we were all again assembled in the birch wood, where we found everything as we left it. No Kurds had been seen; and two or three men whom we had descried with the telescope from the summit in the direction of Great Ararat were probably peaceful shepherds.

Although the advanced season did not allow of any extended botanical researches, yet I was able to recognise on Little Ararat, in several species of plants, the same grades of vegetation as on Great

Ararat, only with this distinction, that on the latter the general limits of vegetation depend on the limits of perpetual snow; on the former they are determined by the steepness of the mountain, and the crumbling, unstable nature of the ground. The height of the birch wood I found by barometrical observation, made on my return, to be 1913 feet higher than St. James's, and 8247 feet above the level of the sea.

A little after three o'clock we mounted our horses, and set off on our way home by a road which led us through the now completely deserted little village of Velijan. The Persian sardar had deemed it expedient to establish a colony in this place, where in ancient times there was an Armenian church with a few habitations, and for that purpose he had removed about thirty families from Arguri to settle here. By this he expected to have the advantage of being able to guard and to make use of the birch wood at the foot of Little Ararat, as well as another lying farther eastward. A little rivulet which trickled down between the two Ararats supplied the inhabitants with good water, on which account they did not murmur much at their compulsory change of abode; but at the end of five years, during the last war, they abandoned the newly-planted village, and the springs too failed, so that the bed of the stream, when we were there, was completely dried up. The remains of the recent dwellings consisted in apartments excavated from the earth to a considerable depth, and in stones enclosing them above the ground. Sahák showed us his former dwelling, for he, it appeared, had been one of the settlers.

In the lower regions, through which our road homeward led us, there was a warm and gentle breath of air; and although it was already dusk,

the ride was extremely agreeable, for the sky had brightened up, and the moon shed her friendly light on the landscape around us. But as we issued from among the ridges and glens through which our path lay, and the comparatively broad valley was opening before us, a magnificent spectacle met our eyes from the distance. On the high mountains towards the Gokchai, in the northeast, there shone brightly some extensive tracts on fire, the darkness of night rendering the flames more vivid. At night there is no perspective; dark objects and burning surfaces furnish no means of forming a judgment as to distance, and accordingly, so long as the cause of the appearance was unknown to me, I gave myself up to the deceitful impressions and other errors of my imagination respecting the distance and magnitude of the phenomenon. But this lent the spectacle a magical charm, which lasted till sober conviction, on the part of myself and my companions, told us that the tracts in flames could be only on the slopes of the Gokchai Mountains, of which conflagration, indeed, I afterward found the traces, on our journey back, on Alaghes and Pambak. On the sides of these mountains were enormous tracts, no longer looking bright and cheerful, but blackened with the smoke and ashes of the consumed grass. I was not able to learn whether this burning down of the dry grass is done on purpose by the natives, or whether it is to be ascribed to chance and negligence. They told me, however, that better grass, in general, afterward springs up in those places.

About seven o'clock in the evening we arrived in Arguri, and alighted for a short time at the house of Stepan Melik, who endeavoured to show his satisfaction at this visit by setting before us a genuine Armenian refreshing meal, and at eight

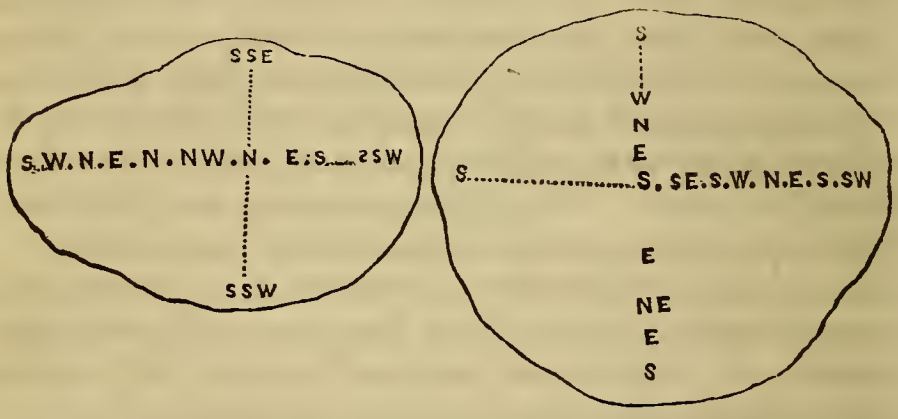
o'clock we again entered our dear monastery of St. James. From this time our thoughts were chiefly directed to our approaching separation from this abode, which had grown so dear to us. M. Fedorov employed himself in packing up the astronomical instruments, a task which, owing to the complicated construction of the Reichenbach theodolite, it took him full two days to complete, notwithstanding all his skill and activity. M. von Behaghel, attended by a Kossak and a guide from Arguri, went on the 30th of October to Erivan by Echmiadzin, for the purpose of making the barometrical observations which we still wanted. I now thought that I might consider my journal of scientific researches on Ararat as closed, when accident led me to a new and important discovery. I had not yet visited the higher parts of the right-hand slope of the valley, exactly opposite to the monastery; and though I did not expect to find anything particular there, yet still I wished to take from that point a view of both the mountains, the sight of which filled me always with renewed pleasure and inward gladness.

I ascended, therefore, to a place lying directly south of the monastery, and 1946 feet above St. James's, or 7280 feet above the sea, and just intended taking the position of Little Ararat more accurately with the compass, when I remarked that the needle, which for convenience of observation I had placed on one of the large rocks of lava, took a decidedly wrong position. I set the needle, therefore, in motion, and pushed it accidentally upon another part of the stone, and then I found that on the several points of the stone it took as many different positions; so that, within a space the size of the hand, the north pole of the needle pointed here to the north, there to the northwest,

here to the east, there to the south, and, in short, to all the points of the horizon. There could be no doubt that I had got before me a magnetic rock. I hastened to try the other rocks in the vicinity—for there were numbers of them lying around in all directions—and discovered in many of them the same property. However much I was rejoiced at this discovery, yet I could not help feeling sorry that it was not made sooner, for it was worth careful investigation; and, at the same time, the alarming thought started into my mind, that probably the stones round St. James's, and the very walls of the church, possessed polarity, and that, consequently, my previous and laborious observations of the declination and dip of the magnetic needle were useless. Moreover, I could not see how I could find time to follow up this discovery and to make good this loss, as M. von Behaghel was already gone, and from the necessity of making my barometrical observations contemporaneously with his, my hours would be all engaged until the moment of our departure, which was now settled on and close at hand. Yet I felt consoled on reflecting that I had observed the dip and bearing of the needle, not only within the monastery at an equal and considerable distance from the four walls, but also outside of the church repeatedly, and that these observations all agreed with one another. It soon appeared, also, on careful examination, that the hill near the monastery, where I had observed the magnetic declination, contained not a particle of the magnetic rock, but was covered with volcanic sand and alluvial earth, and with stones of the reddish, brittle kind of lava, which exerted no influence whatever on the needle. In the church, also, although I tested many of the stones with a very sensitive needle, I found, in like manner, not the

slightest trace of polarity; and, indeed, these stones differed much in look and grain from the magnetic rocks.

In order to arrive at some more definite conclusions as to the way in which the magnetic force was distributed in those rocks, I placed my compass on the middle of one of them, the north point on the card being in a line with Little Ararat, which lay nearly due south, and, while moving the compass over the surface of the rock, chiefly in two directions, I observed the position of the north end of the needle. These observations I made with great care on seven stones, and noted them in my journal; but I here give the results only of those made on two stones. The outer line shows the figure of that surface of the stone on which the experiment was made.



These stones may have been three or four feet in diameter, but the points at which the needle passed from one position to another, as shown in the figure, were on an average not above half an inch asunder, so that the extreme or maximum deviations were comprised within an area about twice that of the hand, from which towards the edges the magnetic attraction diminished in all directions, and at the distance of a few inches beyond the stone it ceased altogether.

The rocks possessing this magnetic property were, in every instance which came under my observation, a blackish porphyry, with tolerably fine vitreous feldspath sprinkled through it, and with other unmistakeable traces of volcanic action. All these masses were very hard and tough, so that I found it impossible to break off a piece exactly at the most effective part. I succeeded in breaking only some of the more angular stones, in which the magnetic action was weaker, yet strong enough to allow of two poles being plainly distinguished, and is even now sufficient, after the lapse of some years, to make the needle deviate fifteen or twenty degrees from its position, at a distance of some lines. In some stones of exactly the same characters externally, and lying close to those above described, I found no perceptible magnetic action; in others, a very weak one—perhaps, however, only because the most efficient part was turned downward towards the ground. The external form had no influence on the magnetic property; I found roundish, angular, and flat stones both with and without magnetism. But that all the rocks of the same kind certainly do not possess magnetic polarity, I convinced myself by observing many of them which lay on the rocky declivity quite exposed towards the valley, not one of which produced any effect; and the same remark applies to the blackish lava which is scattered far and wide in the bed of the river.

Professor Göbel has had the goodness to examine, with reference to the iron contained in it, a piece of this rock having its polarity very strongly developed, as well as another piece, exactly like the former in external characters, but wholly without the magnetic property; and he has found that both of them contain a considerable portion of this metal, that is to say, he obtained from the magnetic

stone 10·7 per cent., from the non-magnetic 10·4 per cent. of oxide of iron. If the iron were to enter into the composition as protoxide, then these proportions would be respectively 9·58 and 9·33 per cent. In any case, this is again a very strong proof that, however combination with iron may be the general condition of magnetic polarity in minerals, yet that the measure in which this property is possessed depends less on the quantity of the metal than on the degree of its oxidation and the way in which it is combined with the other particles.

On the 31st of October everything was ready for our departure. It only remained to procure six horses for our luggage, and two for the saddle from Arguri; but this threatened to involve us in interminable wrangling, for Stepan Melik was not at home, and the inhabitants were unwilling to give their horses, although they knew that they would get the legal hire for them; and I believe we should never have overcome the obstinacy of one of the inhabitants, if our soldiers and Kossaks, making their appearance, had not inspired him with respect for the written order of the authorities laid open before him. About six o'clock in the morning I observed my barometer in the usual place in St. James's for the last time, handed to old Karapet a small present in money, with my hearty thanks, and part of our furniture and utensils calculated to be of use to him; this being done, I received his friendly blessing, and bade him farewell. At two o'clock we were on the bank of the Araxes, where I halted an hour for the sake of the barometrical observation. Then we forded the river in the same place as before, and in the evening, as it was growing dark, crossed in like manner the Sanga, which springs from the Gokchai, and, running by Erivan with great rapidity, hurries into the

Araxes. Its bed was deeper also than that of the latter river, so that our horses, in carrying us across it, had to swim. We spent the night in the Tatar village of Ulkhan, ten miles from Erivan, and in the forenoon of the next day we entered the last-named place, now rendered memorable in the history of the Russian wars. Our road brought us close by the fortress, the works of which consist chiefly of two surrounding walls well provided with cannon. The outer one is enormously thick, and seems to be made of earth; and if it be on that account weaker against the tooth of time, it will, on the other hand, offer a much more stubborn resistance to the balls of the enemy than an ordinary brick wall.

The town itself lies a few hundred paces from the fortress, built partly in the plain and partly on an eminence which stands 600 feet above the Araxes, and 3500 feet above the sea. After we had paid a visit to the fortress, our curiosity impelled us—my companions and myself—to go through the alleys of the great bazar, which, in spite of the turmoils of war, only recently put an end to, and the still more recent devastations of the plague, we found to make a rich display of shops and magazines. We were particularly surprised at the enormous quantity of fruit, fresh, dried, and preserved, all remarkably good and inconceivably cheap. Fresh grapes, of a very good sort, we bought for two copper copeks the pound; others, of a particularly fine quality, cost us four copeks. Some of these promised to be of great use to us on our journey, particularly the extremely delicious dried apricots, and the kish-mish, as they are called, a kind of small raisins without stones, which are much used by the Persians, especially when travelling, to make with rice the dish called ploff, or pilaf.

In our hurry we bought also a few Gallans or hubble-bubble pipes, a few beautifully-platted Persian horsewhips, and some other Oriental trifles, and were just about to go away, when—as if to set before our eyes as vividly as possible the contrast between the Asiatic and European costumes and modes of intercourse—two Wirtemberg women, with five children, entered the bazar, and talked to one another in true Swabian dialect, without ever suspecting on their part that in this crowd of men there could be an ear capable of seizing and understanding their language. These people were from the colony of Katharinenfeld, which was so lamentably despoiled at the beginning of the Persian war, and some of the members of which, carried off by the enemy, were still missing. There was nothing wherein I could be of use to the good people, for the only object of their desires, home, had been already promised to them, and with looks of joy they begged of me, if I arrived in the German settlements before themselves, to tell their friends this news.

After remunerating and discharging the four soldiers of the 41st regiment who had been constantly with us on Ararat, we accepted our deacon's invitation to visit his native home, and our little caravan, escorted only by the two Don Kossaks, followed his guidance to the village of Kanakir. In this place, four miles north of Erivan, his parents and their family still dwelt, although the greatest part of the buildings had been destroyed in the Persian war. Kanakir is, in respect of situation, a most agreeable spot, situate on the slope of the fertile and beautiful Gokchai Mountains, at the height of 4392 feet above the sea. It enjoys a clear, mild, and salubrious atmosphere, and standing 884 feet above the highest parts of Erivan, and 1450 feet above



Mount Ararat from Kanakir.

[*To face* p. 273.

the Araxes, it commands one of the most beautiful views of Ararat, a sketch of which is here given. From this point may be surveyed the wide plain of the Araxes, the course of which river is shown in the sketch by a line of thick mist; in the hollow, behind a ridge of hills, may be descried the highest parapets of the fortress of Erivan; farther to the west (and beyond the limits of the sketch) lies the sacred episcopal seat of Echmiadzin, and farther in the distance the foremost mountains of Taurus. This was a particularly favourable point for taking angles by means of the compass for the purpose of correcting this portion of our map.

From the deacon's father we experienced a most friendly reception, yet it was absolutely necessary for us to hasten on our journey: we therefore hired here five pack horses at the legal rate of two silver copeks the verst.* We did not want any saddle horses from the village, because we had two of our own (the third had been sold), and our two Kossaks were considerate enough to let us hire their horses, while they themselves travelled on foot. Accordingly, we left Kanakir on the 2d of November, about noon, entered the charming valley of the Sanga, where we crossed a very well-built, high-arched bridge over this river, and found ourselves then on the elevated plain of Bash-Abaran, at the foot of Mount Alaghés, through which our road coming had also led us, only more to the west. We had distinctly agreed to the resolution not to take the same road from Erivan which we had come before, but to go along the Sanga to the remarkable Lake Gokchai, and thence down the river Akstafá, the sands of which contain gold, into the valley of the Kur, and so on to Tiflis. But since there was no quarantine on this route, and it

* Equal to a penny a mile.

was necessary to observe strictly all the precautions enjoined by the police, we were obliged to give up this interesting plan, and to take the usual road, on which there was a quarantine at the village of Gerger, at the northern foot of the Besobdal Mountain.

Having spent the night in the Tatar village of Karajuran, where we encountered no difficulties, we met, at a dilapidated and still very lofty old church, carefully built of cut lava, a picket of Kossaks, the officer in command of which refused to receive us, though we entreated him to do so on account of the heavy rain. He had, in truth, only a few huts made of earth, yet one of these would have satisfied us had he thought fit to resign it. It was not till we showed him the order to that effect that he felt disposed to meet our wishes. That was his ultimatum: he felt that he must obey. Perhaps he had learned that my civil rank corresponded to that of colonel, and in that way sought to satisfy the laws of subordination. I also did what indeed occurred most naturally to me at the moment, and *ordered* him to *permit us* to take up our quarters there for the night, which could not occasion him any inconvenience. The object for which these Kossaks were placed here was to give travellers a safeguard to the quarantine of Gumri; but as I did not like to make a circuit, I disregarded the offered protection, and set off on the road to Pambak, the most southern mountain ridge on our route.

Being without wagons or any kind of wheeled carriage, we crossed the ridge, on this occasion, by a short but very steep pass, where it has an elevation of about 8074 feet above the sea, and consequently 287 feet more than the highest point of the carriage road. In the village Hammamlüh, where, on account of the dreadfully heavy rain, we should

gladly have halted, we were not allowed to enter a house, I know not whether from fear of the plague, which we might have brought with us, or from precaution lest we should take it with us from the village, where it still prevailed. At length we found accessible shelter and open doors in the Tatar village of Kursal; yet we took care to remove all the articles of furniture that could be dispensed with from the dwelling assigned to us, and to sprinkle the walls, benches, passages, nay, even the manger in the stable, with chloride of lime, of which I had brought a large quantity with me from Tiflis.

On the 5th of November we crossed the rugged, craggy ridge of Besobdal, at the northern foot of which, not far from the village of Gerger, is placed the quarantine, which was formerly in Bash-Abaran. About two o'clock we reached its barrier, and were immediately led, with all our baggage, to the fumigating chamber. Of course, addressing the physician, who was a German, I resigned ourselves and all our effects to his care, to be dealt with as was expedient. I only begged, in reference to the fumigation, that he would show a little favour to our costly instruments; but it seemed that favour was not to be mentioned in such a case. "Villages," he observed, "are burned, when necessary, on account of the plague, and why should we spare your instruments?" "It is not the instruments alone," said I, "that are undone, but all our work—all our observations made with them are good for nothing, if we cannot observe again with them on our return, and test them; and besides, the quarantine regulations themselves enumerate metal articles among those least liable to contagion; and that there cannot be any contagion in this case is proved by the circumstance that we

alone have handled and made use of the apparatus, which has been packed up now for weeks; consequently the plague, supposing that we communicated it to the instruments, must have been long since worn out." I urged also that I, as chief of the expedition and a physician, felt it imposed on me, as a sacred duty, to avoid most scrupulously every likelihood of contagion. I cannot say that these arguments were wholly without effect, for the doctor allowed me at once, instead of exposing the chronometer to the dreaded chlorine vapour, to wash it in vinegar, taking off the case, and at the same time gave me the most comfortable assurances that it was thereby sufficiently purified.

In fact, my position was very critical; for the doctor, with right on his side, and in accordance with a wise law, his own responsibility also being taken into the account, insisted on unconditional obedience in matters of quarantine from every traveller. Yet in this tragi-comic affair we found the truth of the adage, "When affliction's severest, then help is nearest." The affliction was in my heart, the help came to me down the mountain in an immense caravan with merchandise, numerous camels and other beasts of burden, with a crowd of drivers and attendants. All this was to be received, purified, and taken care of; the doctor hurried out, and handed over our business for an instant to his unprofessional colleague, the commissary, a Russian of unassuming, sensible demeanour. He bid us wash the chronometer externally with vinegar, and to keep it by us; so its life was saved. As for the other instruments, they were shut up during the whole time that we remained in quarantine in the fumigating room, yet under the protection of their cases, and I had the satisfaction, when our durance was expired, to receive them all

in good order—not even a speck of rust sullied the polished edge of my pendulum apparatus.

Since our journey southward to Ararat a change of a very beneficial kind had taken place at these stations. It consisted in this, that at each station there were constantly twelve horses, chiefly belonging to Tatars, kept for the use of travellers, at the usual rate of remuneration, and which might also be employed as pack-horses. At some of the stations, too, there were already the common Russian post-cars or teleggas, which contribute in an extraordinary degree to rapidity of progress.

From the fort Jallal Oglú we made a little circuit down the river, about two miles, to the ancient town and fortress of Lori, which had once been the residence of Armenian princes, and from the peculiar advantages of its situation was well adapted to be such. The surrounding country is, in the first place, the most luxuriant, most healthy, and beautiful to be found in Armenia. The hills are covered with wood, and the place itself seems formed for a stronghold, being impregnable, at least unless attacked with heavy cannon; for the river, with deep, precipitous banks of dolerite rock, making here a bold turn, encompasses three fourths of the place as a peninsula, and on the other side another stream, with a similar deep, rocky bed, joins the former one, thus completing the most beautiful fosses which could be desired for any fortification. Town and fortress both lie in ruins: high, thick walls now tell us of the strength and greatness passed away; but there is no decisive monument to be seen there of ancient, perhaps it might be expected, of classical times. A few large flags bear Armenian inscriptions. Beneath these walls five Armenian families have taken up their abode, and there lead, as far as I could see,

independent and unnoticed, a truly patriarchal life, separated from all near intercourse with the rest of the world, concealed under long-deserted ruins, peaceably disposed, and therefore not needing any communication with superiors. They seemed to be pleased at our visit, and treated us with honey of remarkable excellence, such as I never found elsewhere. They take much care of their bees, and have an immense quantity of honey.

CHAPTER XIII.

German Colonies.—Their Sufferings in War.—History of the Captives.—Excursion to the Shores of the Black Sea.—Badness of the Roads.—Luxuriant Aspect of the Country.—Valuable Timber.—The Vine.—Chevalier Gamba's model Farm.—Saw-mills.—Failure of his Experiments.—Mingrelian Monastery.—Redoute-Kaleh.—Its Insalubrity.—Poti.—Batoom the only good Harbour.—Proposed Canal between the Black and Caspian Seas.—Utility of the Plan doubted.—Caucasus repassed.—Strong Escorts.—Monument on the Sunja.—Hospitality of the Ingushi.—Excursion from the Volga to the Don.—Astrakhan.

In the village of Shulaver, thirty-three miles from Tiflis, I was informed that there was a German colony not far off, and I resolved to pay it a visit. Of these interesting settlements there are seven beyond Caucasus, namely, New Tiflis, on the Kur, a mile and a half above Tiflis; Alexandersdorf, on the Kur, three miles and a half in the same direction; Elizabeththal, seventeen miles west; Katharinenfeld, about thirty miles southwest; Marienfeld and Petersdorf, villages immediately adjoining each other, twenty-three miles east of Tiflis, on the road to Telavi; Annenfeld, eighty-four miles southeast of that city; and Helenendorf, 100 miles from it; the last two in the neighbourhood of Elizabethpol or Ganja. The colonists are, for the most part,

peasants from Wirtemberg, who, in 1819, impelled chiefly by religious fanaticism, resolved to emigrate. After being tried by a most fatiguing journey and manifold afflictions, they at length settled down in their new home into habits of social order, and their lives bore testimony to the successful labours of their zealous ministers, who sought to reclaim them from their religious errors.

These colonies may be known to be German at first sight from their style of building, their tillage, their carts and wagons, their furniture and utensils, mode of living, costume, and language. They contrast, therefore, strongly with the villages of the natives, and very much to their advantage, particularly in the eyes of one who has lived for some time, as was the case with us, wholly among the latter.

I let my companions ride on to Tiflis with the baggage, and went alone to the colony. I took only a Georgian peasant with me as a guide, but sent him back after he had accompanied me a few miles, and had set me on the right road, as he said. But I soon remarked that I must have been ill informed respecting the distance of the village, for I could never get a glimpse of it, and the results of my inquiries among the Tatars were far from being satisfactory. I soon reached the broad valley of a tributary of the Khram. It was covered with luxuriant vegetation, and surrounded with rocky cliffs. I rode up the wild and romantic valley after my uncertain goal, not without suspecting that I had been guilty of imprudence; for if a treacherous or pillaging Tatar had made any attempt on my life, neither my pistol nor my horse could have saved me. At last, after riding for five hours, I espied, high on the left bank of the river, symptoms not to be mistaken of the German colony: these were, regularly-built white houses, with good

windows, doors, and ridge stone on the roof. I joyfully rode up, and found that this was Katharinenfeld. The clergyman, M. Bonivetsch, was gone elsewhere: there was no inn in the place, and the people to whom I first addressed myself received me coldly enough. The scene changed, however, very soon when I told them that, in the course of my travels, I had seen colonists from this place who were on their return from captivity in Persia; for, during the destructive incursions on the Russian territory from the Persian and Turkish borders, made in 1826 by the predatory hordes, for the most part Kurds, when the colonies of Helenendorf and Annenfeld had first become a prey to the murderous cupidity of the barbarians, Katharinenfeld also, in August of the same year, fell under the claws of the same pitiless robbers. Thirty persons of various sexes and ages were killed on that occasion, and a hundred and thirty were carried off into captivity, while the rest, struck with terror and amazement, abandoned their property and goods, and fled to Elizabeththal; for at that time Katharinenfeld reckoned eighty-five families. When I arrived there, there were still wanting, of those taken by the enemy, sixty-five persons. The joy of the inhabitants may therefore be well conceived when I announced to them the return home of seven of those lost friends; and the joy of the afflicted Widmaier in particular, whose wife and three children were among the captives. He immediately took hold of my horse, and brought me a bunch of grapes and glass of wine from his cellar. In the mean time, also, in consequence of my inquiries, the woman named Ehrhardt was found, whose son, sixteen years of age, was also one of the liberated, and she contested with Widmaier the honour of entertaining me.

The fortune of those returning home was briefly as follows: They passed from the hands of the robbers, after being twice sold, into the possession of a wealthy Tatar chief; and the two women, on account of their expertness in needlework and other female acquirements, obtained the favour of his wife, so that they led a tolerably easy life. At first they were teased with exhortations to renounce the Christian faith; but, as they obstinately refused to do so, they were at last left unmolested on the score of religion, only they had a separate tent assigned them, with vessels and furniture for their own little household. On the conclusion of the peace with Persia, the captives made use of their liberty, and were so fortunate as to obtain from their mistress money and clothes for their journey home. Other captives, who, perhaps, on being sold, were carried farther into the interior of Asia Minor, were still missing. But one of the women taken away had the luck to please a Persian priest, and to be pleased with him; at least she wrote to her husband to tell him that she had married a descendant of Mohammed, and to give him leave also to marry again.

After a stay of about two hours I rode back down the valley for an hour with a young peasant, who put me on the road to Elizabeththal, and told me where I might find lodging for the night, and where to seek the preacher of the one as well as of the other colony. The road first lay through the majestic valley of the Khram, the banks of which are formed of the same black, amygdaloidal lava which constitutes so large a proportion of Ararat, and then through the valley of the Alghat. In this last I went astray, for it was here that I lost my pocket compass—my true and indispensable guide on so many mountain journeys. I might have wandered

about all night if I had not come across a herdsman with a few cattle, who pointed out the village, which was close to me, without my ever suspecting it. Here I was richly compensated for my toilsome wandering by the enchanting sight of the double row of pretty little houses, with their regular windows towards the street, and all with lights in them Ah! there is something really grand about such abodes of order, cleanliness, and industry; they are eloquent witnesses of the loving peace of God, true cottages of God's children! I alighted at the house of Jacob Metzger, next door to the dwelling of the pastor Wöhr, who was lying dangerously ill, and for whom his attached flock were plunged in deep and heartfelt sorrow. He and I had become acquainted with each other at New Tiflis. He therefore invited me to see him, and I endeavoured, as far as possible, to reanimate his hope of life, which had sunk very low. But, unhappily, he soon after breathed his last, after having, in the two years of his pastoral exertions, in the midst of cares and troubles without number, succeeded so far that the community, consisting of only sixty-five families, built nevertheless, from their own funds, a very pretty little church in the middle of the village. And yet they felt very sensibly the effects of the Persian war; for, besides their grief and anxiety, they sheltered and maintained, for a long time, the colonists who fled from Katharinenfeld, until the imperial bounty enabled the latter, by a considerable advance of money, to re-establish themselves. In both colonies there is a healthy atmosphere and agreeable climate. Katharinenfeld lies 1750 feet, Elizabeththal 2350 feet above the sea, and in July and August they are much visited from Tiflis.

Besides their tillage, these colonists find their meadows very profitable, for hay is always in de-

mand in Tiflis, and at a good price. The load of hay, such as is usually carried on the German wagon drawn by four horses, there sells for eight or nine silver rubles. In their agricultural instruments, the colonists have made some approach to the customs of the country: thus they have adopted the great Georgian plough, and also the Georgian bush-harrow already described.

From Katharinenfeld there is a short way of about 17 miles from Tiflis, through a beautiful and hilly country, but no one can be sure of finding it who has not great local knowledge; so I rode eight miles and a half to the post-station Kodi, and thence by Teleti to Tiflis, where I found my companions in good health and spirits.

Though our chief business was so far finished, there still remained one work to be executed, independent, in some respects, of our previous labours, but still very important—that was, a journey to the shore of the Black Sea.

The measurement from Tiflis to Ararat, executed with the greatest care from station to station, gives indeed the height above Tiflis of Ararat, and all the other points visited by us, with all the exactness that can be desired; but now, in order to know the elevation of that place above the sea, it would be requisite to execute a similar measurement, by stations between both, on a line of 226 miles, the result of which being added to that already found, would give the absolute height of the several points. For this undertaking M. von Behaghel volunteered to join me, while the rest of our fellow-travellers, taking charge of the instruments, collections, and other things, proceeded with Russian guides on their journey homeward. In my absence, M. Fedorov was the chief of the party. In fact, it was an essential condition of our being able to travel

through Imeretia and Mingrelia in December, that we should have as little equipage and as few wants as possible; and any one who thinks of comfort and accommodation had better abstain from such an undertaking.

Some Russian carriers, who would not believe that there was any road in in the world too bad for their national single-horse car, and who ventured to draw merchandise from Redoute-Kaléh to Tiflis, atoned for their adventurousness by the loss of much time, many horses, and much money. That was the first attempt of the kind made after the opening of the trade between the two places, and it was not calculated to lead to a repetition of the experiment; for I have myself witnessed, on my journey back, when I met with these poor people, how the horses, the usual load of which in the cart is 40 poods, or 1600 pounds, were still quite unable to draw them when the load was diminished to six poods, and how, at last, the carts were abandoned, the bales of goods packed on the backs of the horses that remained, of hired pack-oxen and camels, and these, continually slipping, stumbling, or sinking in the mire, could not carry the goods through without great loss of time. In some places the mountain torrents had swept away the bridges; in which case, owing to the total want of mechanical resources in these countries, the traveller's progress is stopped by insurmountable obstacles. The river Chopi, near which the road runs for a considerable distance, had thrown down and washed away large portions of it. The traveller in this country frequently finds himself standing on ground undermined by some river, and liable every moment to give way. Again, he finds the river in the neighbourhood of the sea overflowing its banks, which are generally from twenty to

thirty feet deep, to such an extent that none but those who are perfectly acquainted with the localities can venture, without imminent risk of life, to find their way through the inundation. We had experience of this on our return from Redoute-Kaléh. We cheerfully followed the Kossak, who rode before us, even when the water reached our knees; but when we saw his horse lose the ground and begin to swim, while he called out to us the fatal words, "Through here, or back to the town; there is no other course," then, I must confess, it required not a little resolution in order to follow.

So much for the road from Tiflis to the sea at this time of the year. Very different from, nay, in extraordinary contrast with, what is stated above, is the impression which the country around makes on the traveller. Although at the time of our journey from Tiflis, and until we had gone some way beyond the borders of Imeretia, the severity of the winter, according to the standard of the country, was such that few could remember anything like it —for example, the thermometer once or twice sank at night ten or eleven degrees below the freezing point—yet nothing could be less like winter than the landscape all around, particularly in the western portion of the route, where luxuriance and vigour of vegetation were displayed to an astonishing degree. Superb woods of gigantic oak, beech, ash, and walnut trees, of apple, pear, cherry, plum, and apricot trees, gladdened, though leafless, the eyes of the spectator: deeper in the mountains, where the foot of a European and botanist never yet trod, grow the tall-stemmed evergreen box, and the *Planera Richardi*, in the Imeretian language called Dselkwa, with its rich foliage, the wood of which, too, has the peculiarity of being at first soft and easily worked, but of hardening by exposure to the

air to such a degree that it is next to impossible to drive a nail into it. This tree is here found with a trunk two or three feet in diameter, and along with it are many other treasures of the vegetable world, little known or not made use of.

Some species of willow and a tall alder may be seen here, adorned with green leaves even in December; the sides of the hills are clothed with fresh grass; the rose-bushes are covered with young buds. Prickly palms, ferns, laurels, rhododendron, all retain foliage in abundance; while here and there are seen dandelion, cyclamen, and a yellow scabious, in full bloom. In these primitive forests, besides, there is a world of plants, which, being less independent than those of stronger trunks, use these as props, and, by way of compensation, lend them the decoration of their green leaves. Thus the ivy entwines itself inseparably round the strongest trees, and develops luxuriantly its vivid green, free from all the dust which defiles that beauteous plant in our climate. The same may be said of the brownberry, the large-leaved convolvulus, the white mistletoe, and many a moss. There is nothing more rich than the ramification and interweaving of the convolvulus, the tendril of which, beautifully adorned with leaves, hangs down gracefully from the top of the tree up which it has climbed, or, tossed by the wind, attaches itself to some neighbouring tree, forming with its ramifications a magnificent festoon, or spreading out into a canopy or a curtain.

But still more attractive than all this—more impressive in its way—is the vigorous growth of the vine. Although now leafless, often dressed out with the borrowed green of the ivy, and owing its support to the other tenants of the forest, the vine still looks like the queen of the woods of Imeretia

and Mingrelia. A stem from three to six inches in diameter leans against the nearest tall tree, generally a beech, and completely subjects it, climbing from branch to branch in countless wreathings, and with knots most artificially tied, till it reaches the very top. Thence its superfluity of branches hang down to the ground, or, not content with the domain already acquired, it fastens on a second and a third great tree, encircles them in like manner, and decorates all the intervening space with splendid garlands.

As to the origin and derivation of the vine in this country, whether it has here its proper home, or was introduced in ancient times, I could learn nothing. The inhabitants whom I questioned on that point were all alike ignorant of the matter. Indeed, the cultivation of the vine, properly speaking, does not exist here; and, in a general view, the only difference between the vines that are gathered and those that grow wild seems to be this, that the Imeretian and Mingrelian is pleased to call the former *his*, and to make use of their fruit. Of the great abundance of this produce, some idea may be formed from the circumstance that the peasant of those countries, who is very poor, and who subsists chiefly on millet, maize, grapes, and wine, yet never thinks of gathering all the grapes which are on his piece of land, but leaves a large proportion of them, particularly those that hang high, to winter and to the birds. Europeans living there have assured me that frequently nearly as late as Easter grapes of the preceding year have been knocked off the trees.

Having in view these natural riches of the country, the Chevalier Gamba, French consul at Tiflis,*

* Voyage dans la Russie méridionale fait depuis 1820 jusqu'en 1824, par le Chevalier Gamba, Consul du Roi à Tiflis, Paris, 1826.

purchased a considerable piece of land in Imeretia, I believe 16,000 dessätines (the dessätine equals 2400 square feet), on the left bank of the Quirila, just at its junction with the Rion, in a district called Varzikhe, and there devoted his property to an experiment, the object of which was to realize his favourite project of civilizing the East, beginning with these provinces. Having been received most kindly by the Chevalier Gamba in Tiflis, where he did his utmost to aid me in the execution of my plans, I did not neglect, on my way back through Kutais, to make a little excursion to Varzikhe, and to make myself acquainted on the spot with what was, at any rate, a very interesting undertaking. A portion of the ground was intended for a complete model farm, and a French farmer received, in a charming site, all that seemed necessary for carrying out the plan. But Nature, who is willing enough to let herself be caught in a quiet way, and then reveals to man for his benefit the secrets of her productiveness, here showed how little it avails to attempt to prescribe laws to her. Not a single crop of wheat succeeded on this extremely fertile soil; the farmer has been discharged, and the establishment given up.

In another place, the Chevalier Gamba, in order to show the utility of the forests of Imeretia, established a saw-mill of very fine workmanship, procuring boards and cast-iron axles from France, and having the whole work erected on the spot by a French millwright. The best kinds of wood were here cut into planks; but the excellent work returns no profit: there is no market for the planks, neither abroad by sea, nor yet in the neighbouring Kutais, to which place, besides, the carriage across the rapid Quirila and the intervening mountains

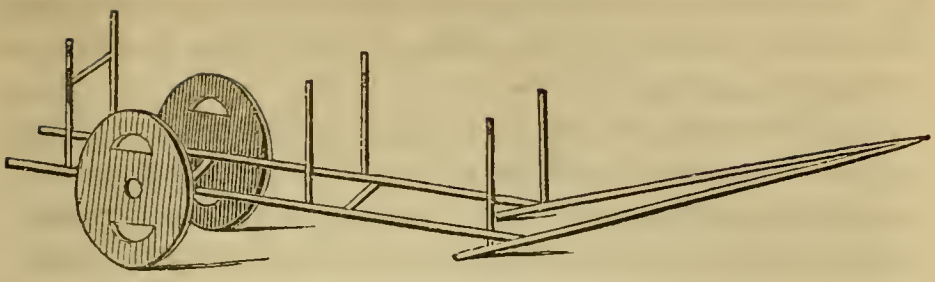
was attended with much difficulty. Chevalier Gamba brought over, also, from France, at his own cost, artisans of various kinds, to help to lay the foundations of industry in the land. They received the requisite funds, and produced satisfactory proofs of their ability. But the Trans-Caucasian cares little for the produce of their industry, because it is not among his wants; and the artisans in question are partly gone back to France for want of subsistence, and partly withdrawn to Tiflis, where they may hope for some employment from the strangers at least, though not from the natives. Haste makes waste.

Domestic life in this country offers little that is gay or agreeable. Endowed by nature with great vigour of mind as well as body, the Imeretian and Mingrelian yet stand at a very low grade of civilization. Not that they are wholly without many useful employments, or even ingenious arts, although the latter have come to them by inheritance; but they seem wholly to want that true joy of existence which is expressed by a cheerful countenance, gay song, and the lively sportiveness of youth, by habitual cleanliness, and, above all, by an enlightened religion. Unhappily, the wretched constitution of the country may be a chief source of the temporary ills which now oppress the people. The greatest part of the population belong to the Greek Church; but there are also Jews among them; and the Capuchins in Kutais are busy in converting both Jews and Imeretians. Besides the 500 Roman Catholics in Kutais, there are many more scattered through the land; and, unfortunately, the religious instruction of the Georgians is not of a kind calculated to satisfy the spirit, or to secure the adherents of the national creed from the attacks of other and proselyting sects.

About forty-seven miles from Redoute-Kaléh I visited a Mingrelian monastery, as it is called: a number of small wooden houses, placed round an oval area; one among them, larger than the rest, was for the Arkhi-Yerei, or high priest, when he came from Kutais, and another was the church, put together, after the fashion of the country, merely with boards, with no farther ornament than images of saints in the rudest taste, and sacred texts, partly in the Georgian, partly in the Sclavonian language. The priest who was there, neither pleased nor displeased at a visit which was certainly a rare and unexpected occurrence, nor entering at all into our feelings, opened the church for us, after repeated entreaty, and then thought fit to show us the form of worship by reading the mass, though I earnestly begged him to leave off. With this monastery there is also a school, yet, as was manifest from the small number of the scholars, not intended for the children of the many; the favoured few were the sons of Mingrelian princes, who ran about barefooted and in rags.

Maize, as has been already observed, is a chief article of subsistence with the inhabitants of these countries; and, consequently, the pounding the heads of the maize are, with spinning, the principal occupations of women and children. A paste is made of coarsely-ground maize and water, and baked on hot ashes: this is the bread called *puri*, which is extremely well flavoured in comparison with the Mingrelian *ghome*, which, made thick and heavy of wheaten or millet flour and water, generally without salt or seasoning, is served up in balls just like the polenta of the Lombards.

Among the implements and contrivances used in Imeretia and Mingrelia, one singular vehicle caught my attention, half wagon, half sledge, and which is used especially in mountainous districts.



The two wheels are complete disks, only that each of them has openings like half moons. They are fixed to the axle, which consequently turns with them, as is the case with almost every sort of wheel-carriage beyond Caucasus. On the axle rest the two chief beams of the wagon, joined by cross-pieces, and furnished with two pairs of uprights to keep together the load, whether straw, hay, corn, or small wood. To this we must add the two poles in front, each of which has an upright staff rising from it, generally a branch of the pole. These staves or branches are now thrust upward through holes bored in the ends of the chief beams, the ends of the poles are tied together, and at the side of them are yoked the draught cattle. In working, this slide wagon, as it may be called, rests partly on the wheels, partly on the hinder ends of the front poles, which, of course, are subject to the wear of perpetual friction, and therefore require to be frequently renewed.

The name of Redoute-Kaléh, a little town on the seashore, appears, at first sight, to be a Franko-Turkish pleonasm—for the two words have the same signification, supposing the latter word to be Turkish; but the true origin of the latter half of the name is probably this, that when the Russians took possession of the place in 1804, they formed in it depôts for corn-sacks, which are called in Russian *kullye;* and in confirmation of this etymology may be adduced the fact, that in the print-

ed tables at all the post-stations throughout the adjoining country, the name of the place is always written Kullye.

In the site of Redoute-Kaléh there is nothing agreeable but the view of the distant mountains; and the town is, moreover, notorious, far and wide, for its extreme insalubrity, whence the great mortality in the local hospitals; for in 1829, out of 4000 men in the place, 800 died. This may, of course, be partially attributable to the defective management of the hospital, and to the want of sanatory regulations in the army; but the chief cause of the evil is undoubtedly the marshy nature of the ground and the humidity of the atmosphere, for nearly the whole year round, but particularly in autumn, winter, and spring, the streets of the town are a deep, unavoidable quagmire, the filth of which is carried by the boots into the houses. That the atmosphere of this place has a tendency to create and maintain tedious, exhausting, intermittent fevers, is proved by the circumstance that even healthy persons who come here regularly become invalids, and the duration of life is, on the whole, very short. It would appear as if there was a regular opposition or contrast in all the particulars of climate between this country and Georgia Proper, so that the one depends on the other, and both climates, as being extremes, are prejudicial to health: here is the greatest humidity and dampness, there the excess of dryness and heat.

The causes of this striking contrast may indeed be, in the case of Georgia, its high situation, its want of wood, and consequent dryness of soil; in that of Mingrelia, on the other hand, its low position, and the dense, widely-spread, reeking forests which cover its soil. In the former, evaporation goes on without the compensation of cool shades,

under the protection of which springs, brooks, and rivers may multiply and gain strength: in the latter province there is the perpetual accession of water from the mountains accumulating and overspreading the low lands, while warmth and light are shut out by impenetrable woods. Hence we may infer the course which ought to be taken to remedy the evils on both sides—Georgia must get back its woods, which it had centuries ago, when its climate was healthy, and the soil of Mingrelia must be brought into a proper state of cultivation. When that is done, Tiflis will no longer need a nostrum for fatal bilious complaints, nor Redoute-Kaléh for inexterminable fevers.

Like Redoute-Kaléh in the character of its site is Poti, situate ten miles farther south on the sea-coast, on the left bank of the embouchure of the Rion. Between it and Redoute-Kaléh is a wood extending uninterruptedly along the shore. As a fortified place, Poti is more important than Redoute-Kaléh, but as seaports they are equally bad; for although the mouth of the Rion, above half a mile wide, might form a most perfect harbour, and the Chopi at Redoute-Kaléh is so deep that a large boat may sink in it till its topmast wholly disappears, yet the sea at both places is so shallow that ships cannot anchor within a mile and a half of the shore, which makes the landing of goods both difficult and expensive. The same may be said of Anapa and all the intervening points, which, but for this circumstance, might offer advantages as ports. There is only one place on this coast, Batoom, not far south of the Turkish and Russian boundary, but not now belonging to Russia, which seems to possess, in the requisite depth of water and the advantageous form of the shore, the condi-

tions indispensable for the formation of a good harbour.

These places on the shore of the Black Sea would be far more important in a politico-economical point of view if there were an uninterrupted water-communication between the Black and Caspian Seas. Such a communication, affording a cheaper and quicker means of carriage for merchandise between Europe and the East, would be a benefit to all trading nations, as well as to the countries forming the channel of intercourse. The project in question has been often agitated, but no attempt has yet been made to carry it into execution. The latest works on the subject start with the proposal to join the Rion and the Kur by the shortest possible line; and it has been ascertained by levelling that a short canal uniting the Kur with the Cheremela, a tributary of the Quirila, which itself falls into the Rion, would be practicable. Without doubting in the least the possibility of such a communication, I cannot, in accordance with my local knowledge, avoid taking into consideration some other circumstances which seem to dissuade from plans involving so much expense. I allude to the characters of the rivers Rion and Kur, which are alike unfavourable for navigation. The former of these, which, on account of the town Kutais, would deserve particular attention, and its tributary the Quirila, fall very rapidly in the upper part of their courses, and have rugged, rocky beds: lower down, on the other hand, where they still have a very strong current, they are continually destroying their banks, so that the permanent use of one of the banks would be attended with much outlay, and the haulage against the stream would be extremely difficult.

The Kur has the same disadvantages, extended

on a much longer line. At Tiflis its bed is rocky, and as uneven as possible, often so shallow that it may be crossed on horseback ; and lower down its ordinary depth is so little, that at present, at least, the only portion of it that can be used for navigation is from its mouth to somewhere near its junction with the Araxes. It would be worth while to consider carefully how all those difficulties are to be overcome with respect to both streams, the Rion and the Kur, before proceeding to trace out a canal of communication, inasmuch as the conversion of these rivers themselves into safe and commodious water-ways would hardly cost less than the construction of an entirely new canal from sea to sea.

From our journey to the seacoast, which was in many respects extremely interesting, while in a scientific point of view it was very important and successful, we returned at the end of eighteen days, and arrived safely in Tiflis on the 21st of December. Our whole undertaking in reference to Ararat being thus concluded, I spent eight days in celebrating the Christmas festival and in preparations for our journey home, which we commenced on the 29th of December. The plague, which had broken out in the district of Dusheti, threatened to throw some impediments in the way of our pro ceeding ; yet we succeeded in continuing our jour ney without delay by adhering strictly to this precaution—from Keshour, on the Tiflis road, not to enter any village nor to hold any communication with the inhabitants. The observance of this rule would have been impossible for us had we travelled with the post, and not with Russian carriers hired for the purpose. We consequently spent the night near Dusheti in the open air, and at Ananur ourselves and our baggage underwent a careful purification in the temporary quarantine. In Pas

sanour, at midnight, I hailed the new year, and in the afternoon arrived at Old Keshour, the highest inhabited point on the south side of Caucasus. The next day, the weather being fine, and a moderate frost affording some security against the dangerous avalanches, I had the great satisfaction of crossing, in the midst of winter, this lofty mountain ridge, environed by enormous precipices, and on which the road attains the height of 7977 feet above the sea. On my journey southward I had found the height of this point above Kobi to be 1590 feet; I now found it to be 1588 feet, differing only 2 feet from the former measurement—an agreement with which I was the better pleased, as on both occasions the measurement was not the result of contemporaneous observations at the two places, but of observations made in succession.

In order to avoid difficulties and dangers, we had taken the most of our things from the wagon, and packed them on two horses; we also took three soldiers from Keshur to assist us, and thus we proceeded, not without some trouble, along the narrow road which winds round the lofty and precipitous sides of the Gud and the Cross Mountains. It was covered with snow, and in many places sloped so much towards the outer edge that it required all our united strength to prevent, by ropes, the wagon from falling over into the abyss below, in which case we should never have seen it again; yet, after an extremely pleasant journey, we arrived in perfect safety, in the afternoon, at Kobi, where, as our horses were completely tired, we rested one day. A little below Kobi the snow ceased, but the hard ground and frozen rivulets distressed the horses exceedingly. We set off from Kobi about three o'clock in the morning, proceeded by bright moonlight through the pictu-

resque and thickly-peopled valley of the upper Terek, and at break of day reached Stepan Zminda, in sight of the majestic snowy cone of the Kasbeg.

The lively recollection of the time that I had spent in this quarter eighteen years before induced me to stay here for a few hours, to contemplate attentively the well-known rocky summits and plains of ice and snow which I had so often gone over: they impressed on my mind a vivid and soothing image of the grandeur and endurance of such sublime works of the Creator. But I had to visit the interior of the castle of Kasbeg, and the tomb of the old prince, once the powerful chief of an extensive territory. The dispersion of his family was another topic of my inquiries, and also the reappearance of his son Nicolai, a young man of fine figure, but broken constitution, with a countenance far from captivating. Then I sought in vain for some trace of the revolution in the manners of the people, for which the philanthropic General del Pozzo, commander in Vladikavkas eighteen years before, had laid so excellent a foundation. The selfish and ambitious intrigues and turbulence of the native chiefs, with all their affected zeal to promote the views of the Russian government—this, and many other matters of the same kind, which I saw and heard of, recalled me from the mountains, to which my spirit, in admiration of ever-charming Nature, involuntarily winged its flight; they filled my heart with sorrow, and bid me fly from a country where the ornament of creation detracts so much from its beauty. We then went on through the narrow pass of Dariel to Lars. Here the danger of robbers is always a serious affair. There is no travelling without a strong military escort, nor before or after the morning and evening signals; our advance from this, therefore, was somewhat

slower, yet we reached Vladikavkas without any accident.

We wished much, on scientific grounds, to be able to examine the valley of the Sunja, which is still unknown to naturalists. This river is a tributary of the Terek, and flows through a wide valley between the latter stream and the mountains. The Russian dominion is here confined to the narrow precincts of the three fortified points, Nasran, Pregradnoi, and Grosnaya, the second of which places, moreover, was taken some years ago by the natives, and totally destroyed. Under the military protection of 100 infantry, 50 Kossaks, and one piece of artillery, we continued our march, crossing the Kumbileika once, and the Sunja, in which there was at that time a foot and a half of water, twice, to the well-appointed and pretty fortress of Nasran, where we spent the night, and then, escorted by 120 infantry, 15 Kossaks, and a piece of cannon, we proceeded on to the village of Ammekhan, nearly three miles from the dismantled fortress of Pregradnoi. On the way, about four miles from Nasran, we rode to a hill about a hundred feet high, in the valley of the Sunja, on the left side of the river, on which there is a monument of some antiquity. This was a small building above the ground, with thick walls of rough stones, but faced both within and without with hewn stone, and having, about four paces within the walls, a semi-conical cupola. From the middle of the floor an opening about two feet wide led into a small vault, at the bottom of which, covered with stones and much rubbish, lay two human mummies, with their legs stretched out, and their arms crossed upon their body. The soft parts had dried up very much, and both were little more than skeletons with the skin on. There lay also three skulls in the tomb, which, like those

above mentioned, were skulls of men of the Caucasian race, and not, as they might very well have been, of the Mongolian. Two hares also, dried up, and a dog, lay close by: whether originally laid there with the corpses, or subsequently fallen in and converted into mummies, cannot now be determined. The shell-lime, of which the neighbouring hills consist, and which was probably used for the building, may possibly have exercised a preserving influence on the animal matter. On the cut stones of the monument are plenty of Tatar inscriptions. I had only time to copy one of them, the meaning of which, not very satisfactory, was simply, "Ahaha has built this."

We had no sooner arrived at Ammekhan, a village of the Ingushies, and had halted, than a numerous body of armed men came forward, and inquired, mistrustfully but fearlessly, as to the cause of the appearance of this military force. They allowed only M. von Behaghel and myself to enter the village, and lodge there for the night, yet without any soldiers; but in conceding to us the right of hospitality, they gave it without reserve, inasmuch as they resigned to us a perfectly new and neat cottage. Our carrying guns and pistols did not give them any offence, as they themselves go always armed. These cottages are made of wattles plastered over, and have very flat roofs; they have a regular door, some openings for light and air, and a chimney. They are easily kept clean, the plaster allowing of being either scoured or whitewashed. While we were warming ourselves at the fire and taking tea, we were visited by the elder or chief, and also by the widow to whom our abode belonged. The conversation, carried on through an interpreter by the people of this village, was so frank, confiding, and innocent, that one

would suppose that hostile relations had never existed between them and the Russians, and yet the slightest provocation or arbitrary act on the part of the soldiers bivouacking near the village would have instantly called out all the inhabitants in arms. So it is with the hospitality of these men of nature, not yet obedient to the influence of modern civilization. A few needles and some thread, which we presented to our pretty hostess, and some others who were present, diffused general satisfaction. Late in the evening, when the village was all in darkness, I took a fancy, while walking in front of the cottage, to see the interior of some other habitations, and so I went to the house of the chief, where I found three men sitting before the fire and eating their supper. My entering did not disturb them in the least, but they immediately saluted me in friendly terms, and requested me, very courteously, to sit down between them on the best cushion, and to take a share of their frugal meal. I did both, as it was impossible to reject so well-meaning an invitation; and afterward they allowed me to examine the furniture, and various articles in the house, among which the arms and horse-gear were best deserving of notice. One of them then, on account of the fierce dogs in the village, saw me back safely to our dwelling, and there, in the midst of these bitterest enemies of Russia, I lay down to rest with as much quiet and security as if I were at home.

About five miles from this village we found, on the plain, a military escort of 300 infantry, fifteen Kossaks, and two pieces of artillery, under the command of three officers, sent forward to meet us from the fortress of Grosnaya. The greater insecurity of this district made a larger force necessary; and we owed this anticipation of our wants

to the kindness of General von Engelhardt, who commanded in Grosnaya, and who received us with all the warmth and heartiness of a friend. M. von Behaghel, who happened to be indisposed, was fortunate in here obtaining the professional assistance of M. Ivanof, of the medical staff.

We were highly interested in observing, with our own eyes, the good understanding which General von Engelhardt has been able to establish with some of the principal chiefs of the mountain tribes, in consequence of which, these people, overpowered and enchained by the superiority of moral influence, are now in a fair way to attach themselves sincerely to the interests of the Russian government; for uprightness, incapable of being corrupted, and never made to vacillate by self-seeking, takes effect, in time, even on the most lawless robbers. It was also very gratifying to me to meet in Grosnaya with M. Lenz, who, at the desire of the Academy of Sciences in St. Petersburg, accompanied the expedition of General Emmanuel to Elbruz the year before, ascended nearly to the summit of that mountain, then made a series of pendulum observations in the observatory at Nikolayef, and now had it in contemplation to proceed to Baku.

From Grosnaya we travelled, by Nour, to Kislyar, where my chief business was to collect information respecting the ways and means of making an expedition to what are called the sources of the Manech, which are about forty-eight miles from the shore of the Caspian Sea. Of the object of this proposed expedition, and of the impossibility of carrying it into effect at this time of the year, I have given a full explanation in a special memoir. Instead of it, we made a journey for the purpose of barometrical measurements from the mouth of

the Volga up to Zarytzin, thence across to the Don, and along its stream to the junction near Old Cherkask—an undertaking which has been also described in a separate memoir. On this journey, at the residence of the Kalmuk prince Timeniev, not far from Astrakhan, I met with Professor Hansteen, who was returning home from his important journey to the Asiatic magnetic pole: this encounter I must reckon among the most fortunate incidents of my journey.

The postroad from Kislyar to Astrakhan leads through a low, barren steppe, not far from the morasses and reedy fens that border the Caspian Sea. Light sand, with fragments of seashells, are driven up and down by the wind, and give the ground an undulating but very changeable surface, so that often every trace of the road is obliterated in two or three hours. Here and there are salt-lakes of various sizes, not far from the road; at times, a numerous group of them together. Many were entirely dried up; the rest we found frozen. The inhabitants collect the ice in order to have fresh water, which is in that country very rare. At the bottom of these salt-lakes is found, under a thin layer of sand, black earth having the offensive odour of sulphuretted hydrogen.

The post-houses are clean and simple; very tolerable for travellers who have not many wants, and the despatch is good. It is not till we reach the last stage before Astrakhan that we see fixed settlements of Tatars, with regular houses above the ground, having windows and chimneys; in the last villages, too, they have a few trees. On the previous portion of the route there are, at the best, only the moveable kibitkas of the wandering Kalmuks and Karanogays.

Our excursion for the purpose of levelling from

Astrakhan along the Volga, and from the Don to Cherkask, took us but twelve days. We had every reason to be satisfied with its success; and on the 13th of February we left Cherkask, M. von Behaghel and myself, and passing through Voronesh, Tula, Kaluga, Smolensk, and Pleskof, hastened home, where I arrived in safety on the 1st of March, 1830.

JOURNEY TO ARARAT.

SCIENTIFIC PAPERS

SCIENTIFIC PAPERS.

ON OUR BAROMETRICAL LEVELLING IN GENERAL.

The barometers which we employed in this expedition were cistern-barometers, constructed in Dorpat under my own direction. The cistern was made of folds of paper pasted together, and when thus rendered thick enough, well coated with varnish; viewed in its horizontal section, it was a parallelogram with the angles rounded off. The bottom of the cistern was of wood glued in; the top, of cork with a hole for the tube, which fitted tight in it without any cement or luting. At the side of that hole was another smaller one, with a cylindrical rod immediately above it, which when lowered closed it completely, and was fastened with a screw. Thus, at great heights, when the mercury sank low in the tube, it could flow over the cork lid which was below the rim of the cistern, and a little dexterity was all that was required in order to bring it, by inclining the barometer, back again into the tube and cistern, so that the latter being stopped, the instrument might be fitted for being carried. By this means all the advantages of a cistern-barometer were secured, and, at the same time, the quantity of quicksilver required was reduced to a minimum, for, in fact, no more of it was wanted in the cistern than sufficed to cover the end of the tube. It is obvious that, by reducing the quantity of mercury, the weight of the instrument was also diminished, and with it the liability to fracture.

The cistern and tube being thus arranged, we next come to the means of measuring the column of mercury. My scale is divided into half lines, of which the nonius gives tenths; and of these, again, it is easy to estimate halves by the eye, so that on the whole the fortieth part of a line, or 0·025‴, may be read off with certainty. The scale slides up and down, governed by a screw, and fixed with a clamp. On the lower end of the iron wire which carries the scale is an ivory cylinder, hollow and open below, so that a spur or point of ivory rising vertically from a flat piece floating on the mercury can move easily in it up and down. The cylinder is filed away in the middle to about half its thickness, so that the spur which floats on the mercury may be seen distinctly within it. Round that spur is marked, in a horizontal plane, a fine black line, and a similar line is also drawn across the exposed interior surface of the cylinder. At every observation care must be taken that these two lines be brought, by moving the scale up or down, to coincide exactly: this being done, it is evident that the scale will be always at the same height above the surface of the mercury in the cistern. The piece of ivory here supposed to float on the mercury will doubtless sink a little in it; but this circumstance has no influence on corresponding observations, and may be easily allowed for if special purposes require it. I know of no mode of ascertaining the level of the mercury in the cistern so simple, easy, and so sure as this.

The mode of observing the height of the mercury in the tube is equally simple. The nonius carries an index composed of two slender silvered plates, one behind the tube, the other in front of it; the latter extends only half way across the tube, the former projects beyond it; and on both are drawn

fine black lines in the same horizontal plane. It is easy now for the observer to move the nonius till the plane of these lines touches the summit of the column of mercury. This kind of index requires only light in front, and not thorough light, and is therefore well adapted for night work. On account of the index above described, and also for the sake of allowing the air to circulate freely round the tube, this must stand at a little distance from the frame or case which supports it. The lower portion of it is attached to the case by three fixed props; the upper portion is sustained by pieces of wood which slide into loops of chamois leather glued to the case. These wooden supports are easily removed to allow the passage of the index up or down. When the case is shut, leathern cushions on the inside of the lid press gently against the tube opposite to its wooden supports, and keep it firmly in its place.

A small piece of glass tube sunk in the case contains a little pendulum of brass wire, suspended from a hook above, and pointing below to a black mark in the tube containing it, when the barometer hangs exactly vertical. This simple and compendious contrivance is indispensable for accurate observations; for in case of wind, there can be no certainty of the barometer in the open air hanging vertically by its own weight.

The body of the attached thermometer is made by joining a fine and even tube, such as is usually selected for thermometers, to a piece of tube exactly equal in respect of width and thickness to that of the barometer. Without this precaution, no reliance can be placed on the observations, for every other contrivance resorted to for the purpose of establishing uniformity in the changes of temperature between the mercury in the barometer

and that in the thermometer is very uncertain in its operation; whereas it is impossible that a thermometer made in the manner above described can have a temperature different from that of the mercury in the barometer, both being freely exposed to the air, as may be easily deduced from first principles, but which I have also proved experimentally. This thermometer, therefore, gives me, at the same time, the temperature of the air, and saves the trouble of employing a second, or, as it is commonly called, a detached thermometer. If, owing to the thickness of the glass, it does not indicate very slight or momentary changes of temperature, this, the object in view being considered, is rather an advantage than a defect.

The case or frame to which the tubes are attached, and the lid (which is fastened to the case with hooks on both sides, so that it may be taken off completely when the instrument is about to be used), are both made of perfectly seasoned wood, externally free from projections, and of an equal thickness throughout — a form which conduces much to the safety of the instrument in case of falls. A cover of stout leather protects the barometer from dust and rain, and a belt attached serves for carrying it over the shoulder.

In case the tube should happen to be broken, there is no difficulty in renewing it, since all the joints and fastenings of the instrument are easily arrived at, as may be learned from the foregoing description; even the connexion of the tube with the cistern may be speedily interrupted and again restored, being effected merely by passing the tube through a hole in the cork lid of the cistern, and in which it fits tightly. For the purpose of expelling the air from the quicksilver in the tube, I have never used any other means than the heat of red-

hot coals; and I can confidently assert that I never lost a tube by the process.

The safe carriage of reserve-tubes requires on a long journey quite as much care and precaution as that of the barometer itself. I have found the following method to be equally secure and simple. The tubes, being cleaned, closed at one end, and cut to the required length, are covered with bladder at their open ends, to protect them from dust; yet, to avoid making the end unduly thick, the bladder must not be tied on, but made to adhere of itself. Round each of the tubes are rolled, in four places, strips of blotting paper about three inches wide. These strips must be pushed to different parts of the several tubes, so that when the latter are placed together, they may lie as compactly as possible, and not be collectively thicker in one part than in another. They must be then wrapped altogether in blotting paper, afterward sewn up tightly in flannel, and slipped into a strong leaden case, which is to be bound fast between two pieces of wood hollowed to receive it; in this way ten or a dozen reserve tubes may be carried with the greatest safety in a parcel not thicker than a man's arm.

A small stock of thermometer-tubes, such as are above described, packed separately, necessarily forms a part of the preparations made by foresight.

This mode of constructing a mountain barometer has also this great advantage, that, with a little practice in the use of it, one runs no risk of breaking the instrument; for if, on my expedition to the summit of Ararat, I had not fallen on the steep ice and rocks, on which occasion not only was my barometer broken to pieces, but my bones, too, narrowly escaped the same fate, the barometer would have made the entire journey of 2000 miles from Dorpat over Caucasus to Ararat and back

again, in almost daily use, being always with me whether I travelled on foot or in a carriage, or rode Kossak or Kalmuk horses; for it met with no other accident, and it stands at this moment before me just in the same condition in which it stood on the top of Ararat after it was repaired.

We ordinarily devoted an hour to the observations at each station, and noted them every fifteen minutes; we rarely limited ourselves to half an hour, although this is quite enough to allow the temperature of the air to produce its full effect on the thermometer and barometer; but where it was possible, as, for example, in the morning and the evening, at the first and the last observations, and also when it happened that one of us arrived at his station sooner than was reckoned on, we always continued our work in such cases longer than was actually requisite for one or two contemporaneous observations, and this is a precautionary measure which I cannot too strongly recommend in the case of a system of operations for the ascertaining of levels; for, in the first place, it happens frequently that one of the two observers arrives late at his post, and then it proves to be a great advantage if the other shall have continued his observations beyond the usual time; and, secondly, it may even happen that, owing to the tardiness of one of the travellers, no actual contemporaneous observations shall have been made. In this case, if it should happen that the other began his observations earlier, and continued them above an hour, then the hourly course of the barometer at that time may be deduced from them, and it may be easily and with tolerable certainty calculated at what height it would stand a quarter or half an hour later.

As to the distance between the stations at which the contemporaneous observations were made we

thought it better not to fix on any determinate length, because the errors likely to arise from the difference in the states of the atmosphere at the two points, in case of too great a distance, were less to be dreaded than the danger that the observer who followed might not find the spot where his precursor had stationed himself, and so might miss the observation, while the other would still go on unconcerned from station to station. In countries like those which we levelled, where, among those best acquainted with the localities, distances are measured very inaccurately, or not at all, and where the traveller, making his way over mountain paths, through morasses and inundations, finds his progress repeatedly checked by unexpected hinderances, it is of the greatest importance, in order to be able to obviate readily each difficulty as it arises, that the system of proceeding be as simple as possible.

With respect to the place of observation, we have always selected it, if possible, in the open air, and, at the same time, in the shade, where the pressure and warmth of the atmosphere might exercise, undisturbed, their full influence on the barometer.

For the purpose of suspending the instrument from houses, trees, posts, &c., we always carried with us a hook with a very sharp screw; in the open plain or at a distance from those aids, we hung it from a light tripod of wood; but the observation may be also made without any such support, by merely propping the barometer on the ground, and holding the upper end of it with the hand; though this, it is obvious, ought to be done only during the moment of observation, previous to which, care should be taken that the instrument be not affected by the warmth of the observer's person.

I have calculated my observations collectively, according to the formula of La Place, using for the reduction of the heights of the mercurial columns to equal temperatures the simple method recommended by Gauss.* I have sought no help from tables of any kind, those of logarithms excepted, as I believe that such aids conduce neither to despatch nor to accuracy.

ON THE DIFFERENCE OF LEVEL, AND PROBABLE FORMER CONNEXION OF THE BLACK AND CASPIAN SEAS.

Since the publication of the barometrical measurement which I executed in 1811, in company with M. von Engelhardt, at the northern foot of Caucasus, between the seas above named, it has been generally assumed that the level of the Caspian lies about 300 French feet lower than that of the Black Sea.

But the more interesting this piece of information is, as far as regards physical geography, and the more attention and confidence it has met with from philosophers, so much the more important in the eyes of us who were the authors of it becomes every fact which seems either to confirm or to contradict that result. I shall not refer to the barometrical observations, which have been made in greater or less number, partly on the shores of the Black and Caspian Seas, and partly in the interior of the country, at various places connected with them by rivers, and from which observations hypotheses may be easily derived respecting the relative levels of the two seas. The instruments with which those observations were made were all de-

* Bode, Astron. Jahrbuch (Astronomical Annual), 1818, p. 170.

ficient in one essential requisite, namely, the being compared with one another, or else such an exact account of their construction and degree of accuracy as would serve instead of that comparison, and would enable us to calculate the relative value of their indications. I shall here direct attention only to the following two simple facts, which are calculated to weaken our confidence in the certainty of the above-named result.

We know of but one measurement executed in the region referred to with consummate skill and worthy of entire reliance, namely, that due to the labours of M. E. Hofmann and M. G. von Helmersen. By means of an extremely exact series of station-levels from Orenburg along the river Ural to the shore of the Caspian Sea, as well as by barometrical observations continued for a whole year at both the extreme points, these gentlemen determined with rare precision the height of Orenburg above the Caspian Sea, and of course the elevation of many other points; but with respect to the relative levels of the two seas, their labours, which had not in view the solution of this problem, warrant no direct inference. According to their measurement, Orenburg stands 330 feet above the Caspian Sea; as to its elevation above the Black Sea, and, consequently, of the latter above the Caspian, there are no means here afforded of arriving at a satisfactory conclusion.

The Don and the Volga, about 270 miles above their mouths, are distant from each other 40 miles perhaps, the former near Kachalinsk, the latter near Zarytzin. At this place, the respective levels of the two rivers have been geodetically determined by the officers superintending the water communication, and it has been found that the Don is about 140 feet higher than the Volga; the former river

also flows to the Black Sea with more rapidity than the Volga to the Caspian. It thence follows that the difference of level of the two seas, supposing that such difference exists, must at all events be considerably less than 140 feet. The details of the geodetical measurement are unknown to me; but an accurate barometrical levelling which I executed, in conjunction with M. von Behaghel, a few years ago, between Zarytzin and Kachalinsk, gave 170 feet for the difference of level, and consequently confirmed the assumption respecting the greater elevation of the Don; a fact, indeed, which could hardly escape the notice of an observant traveller without the aid of instruments, who, going from Zarytzin to Kachalinsk, should compare the considerable ascent in the first half of the journey with the very moderate descent at its termination.

The second circumstance which raises scruples in my mind respecting the matter in question is the river Manech, which, rising in the Kalmuk steppe north of Caucasus, where the Sea of Asof and the Caspian approach nearest to each other, and, according to our best maps and latest information, about 50 miles from the shore of the Caspian Sea, flows westward to the mouth of the Don, and consequently to the Sea of Asof and the Black Sea. From this circumstance, one would expect to find an elevated coast at the Caspian Sea, or, at least, a very perceptible ascent from the shore towards the interior of the steppe, in order to explain the difference of 300 feet between the levels of the two seas, together with what must be allowed for the fall of the Manech in a course of nearly 350 miles; but instead of this, we find the whole shore of the Caspian Sea, north of Caucasus, so low and level, that, as the numerous creeks marked in the maps indicate, it is intersected with

drains, and covered with reeds for a width of from six to ten miles; this low land being completely inundated, or, at least, rendered impassable by heavy rains or the continuance of sea winds. Towards the steppe, on the other hand, the ground is undulating, that is to say, it presents a succession of elevations and hollows varying from 40 to 80 feet; but these consist of the lightest drift sand, so that the road to Astrakhan is often completely blown away, and changes considerably from day to day. The direction of these ridges is, with hardly any exception, from west to east; they do not, therefore, prevent the Kuma from flowing eastward to the Caspian Sea, and from proving, at the same time, that there is no general elevation of the ground along these shores.

Similar considerations are suggested by the peculiar course of another stream of this region, the Sarpa, a river of the steppe, which rises in the low hills not far from the sources of the Manech; and as often as heavy rains or melting snow fill its bed with water, flows, not to the Caspian Sea, which lies so low, according to the alleged measurement, but directly northward, and unites, near Sarepta, with the Volga, flowing in a nearly opposite direction.

Now supposing that there is no great difference of height between the sources of the Manech and those of the Sarpa—and of this fact I am nearly certain, partly from my own knowledge of the adjacent country, partly from the descriptions of wandering Kalmuks and of Armenians from those districts, and partly from the information of merchants who have travelled with the caravans, which often take the road over the tract in question from Astrakhan to Georgia—then we may consider it proved that the Caspian Sea cannot possibly be

300 feet below the level of the Black Sea, inasmuch as from nearly one and the same point the Manech flows slowly to the Black Sea in a course of 350 miles, and the Sarpa descends much more sluggishly the short distance to the Volga, the fall of which from that place to the Caspian Sea cannot exceed 50 feet.

I had hoped to find, on the occasion of my journey to Ararat, a convenient opportunity of clearing up the doubts arising from these and similar considerations respecting the relative levels of the Black and Caspian Seas, and of executing for this purpose a barometrical levelling through the steppe on the northern side of Caucasus, along the Manech, where the two seas are not above 400 miles asunder. M. von Behaghel was my fellow-labourer in this station-measurement, and, in order to facilitate our progress, I attached to him the imperial feldyäger. Our instruments were of the kind described in the preceding paper. They were daily compared with each other; the thermometers nearly coincided throughout; barometer *a* stood lower than barometer *b* in the eight comparisons made during the excursion, the mean difference between them differing from the maximum and minimum not above the 33d part of a line. It is obvious that the errors arising from this source might be safely disregarded.

It is of great importance—much more so than I formerly supposed—that the observations throughout should be contemporaneous. We missed the time at only four stations, so that the observations twice differed a whole hour, once they differed three quarters, and once half an hour. But on the occurrence of these delays, which must be expected in the midst of inhospitable steppes, where distances are so little known and the means of travel-

ling so uncertain, we agreed, as a countervailing measure, to observe at each station, not merely during the appointed time, but, in general, every quarter of an hour as long as we stayed there. By this proceeding, and by means of the comparison of the successive observations of both travellers at the same station, it may be easily ascertained whether and at what rate the baromiter is rising or falling during the whole time, and thus, supposing its movements to be in any degree uniform, observations which are not contemporaneous may still be reduced one to the other with tolerable accuracy.

With respect to the horizontal distance between the barometrical stations, it may be preliminarily established as a general rule that it ought not to exceed 12 or 13 miles; but the observance of this rule must depend on local circumstances, which, as has been shown in the narrative of our expedition, are above control. It has been related also, in that narrative, why we commenced the levelling 25 miles above the mouth of the Manech, and continued it only as far as the junction of that river with the Kaláus, instead of to the shore of the Caspian Sea. The portion levelled extends about 170 miles, and was divided into 19 barometrical stations. These had consequently an average length of nine miles, and were therefore short enough to be secure from the errors likely to arise from the circumstance of the atmosphere being in different conditions at their extremities.

We began our observations at the hutor or estate of Balábin, close to the bank, and two feet above the water-level of the Manech, which was at that time spread to the width of a mile and a half, and, growing still wider lower down, extends for a long way as a narrow lake as often as it is swelled in spring by the floods from the melting

snows of Caucasus, borne down to it through the steppe by the Kaláus and the great Yegorlik. By the account of the people in Balábin, the Manech must at that time, the 16th of May (28th, new style), have been from one to two fathoms deep; on the other hand, in hot summers it dries up to such a degree that its bed may be walked over without wetting the feet.

An estimable staff-officer, Major-general Bogdanovich, who, in the execution of a brief but correct survey of the Manech from its mouth to the bounds of the Don-Kossak country towards the government of Astrakhan, had the opportunity of becoming well acquainted with this river, assured me also, when I met him in Cherkask, that in the absence of floods the current of the Manech is so weak that the river hardly seems to flow, and that it moves towards the east or west according as the wind blows. Ten miles higher up I found the stream confined within a regular bed, the northern or right bank of which was a cliff 50 feet in height, while the southern or left bank was comparatively low. In this place the current was very perceptible, like that of a river of moderate velocity.

We found the increase of the Don to be coincident with the flood of the Manech. In the neighbourhood of New Cherkask, the former river, with its adjuncts, the Aksai—a branch which, issuing from the Don on its right bank, joins it again lower down—and the Sussat, which, on the left side, forms a channel of communication between the Sal and the Manech, spreads out into a lake 12 or 14 miles broad, which we had to cross at a place where it had a width of six miles, in order to reach the Manech. In New Cherkask we found it to be assumed that the Don had risen four fathoms; and as we crossed it, the boatmen from the neighbour-

hood said that it was seven or nine feet higher than in summer. The Tuslof, again, which flows from the steppe into the Aksai, near New Cherkask, was said to have risen seven feet. All this corresponds exactly with the magnitude and distance of the sources of those rivers, and leads to this result, that the Manech, from the place where we began our levelling to its junction with the Don, a distance of 25 miles, may have at the utmost a fall of two or three feet.

The termination of my measurement in the steppe happened also to be on the bank of the Manech, and a foot and a half above its level, between its junction with the Kaláus and its long expansion, marked in the maps as the Manech Lake. The country here on the northern or right bank is undulating, with heights here and there of probably 200 feet, the hollows between them being softened or thoroughly saturated by heavy rains, or, perhaps, by the overflowing of the Manech. The river at that time formed two branches, the greater one about 50 feet wide, but not above $2\frac{1}{2}$ feet deep at the utmost, so that we could ride through it without danger of wetting our feet; the other somewhat broader, but much shallower, and which is completely dried up in summer. We observed in both a weak current westward.

On calculating the series of observations made along the course of the Manech, we find for the fall of that river during the floods 13 feet in a course of 170 miles, or $\frac{9}{10}$ths of an inch per mile; but in summer, when the level of its outlet lies about nine feet lower, the whole descent for 200 miles ($2\frac{1}{2}$ feet being added for the fall from Balábin to the mouth of the river) may be estimated at 25 feet, or an inch and a half per mile, which corresponds perfectly with the sluggishness of its course.

The operations above described did not, it is manifest, complete the original design of levelling over the sources of the Manech to the very shores of the Caspian Sea; yet we saw the mysterious river, we levelled the greater part of its course, and convinced ourselves that all appearances which would indicate a considerable difference of level between the Black and Caspian Seas were to be looked for only in the eastern half of the Caucasian isthmus—in the tract, about 130 miles wide, between the Kaláus and the Caspian Sea.

When I was returning over Caucasus, at the conclusion of my journey to Ararat, I had it much at heart to visit that, now doubly interesting, tract; but it was at that time the middle of winter; the ground was covered with snow; all the Kalmuks had withdrawn from the steppe to winter-quarters on the Kuma, or the shore of the Caspian Sea; and had we gone to the expense of carrying with us fodder for the horses, we should still not have seen the Manech itself, nor perhaps have even once recognised with certainty its shallow bed, as all the streams were dried up in the summer, and completely frozen in the winter.

In Kislyar, which I passed through on my return, I received some very remarkable information respecting the character of the eastern part of the Manech, which I must not withhold from my readers, as it appears to me to be fully entitled to credit. I obtained it from an Armenian named Semen Petrovich Gambiaranz, who, though now living in affluence in Kislyar on the produce of his herds and his droves of horses, was born in the Kibitka, reared in the steppe in nomadic life, and knew the country on the eastern Manech and round the Kuma as the land of his birth and early wanderings. According to the frequently repeated state-

ments of this man—who, at the same time, was far from supposing that he related anything new or important—the eastern Manech has its origin, not near the Caspian, nor does it flow from east to west, but it proceeds from the Kaláus, and flows eastward, receiving nine or ten rivulets from the steppe, and attaining a breadth of 40 or 50 feet. It does not, however, reach the Caspian Sea, but terminates about 50 miles from its shore, and about 24 miles from Guiduk, a station on the postroad to Astrakhan, in a lake called by the Tatars Gockoll, by the Kalmuks, Kökussún. This lake is about 14 miles in circuit, and contains brackish water, which remains throughout the summer, whereas the Manech dries up at that season, and continues dry all the winter, as it receives its supply of water chiefly from the Kaláus, which during winter and summer is itself a feeble stream, though on the melting of the mountain snows in spring it becomes a great torrent.

Respecting the western Manech and its connexion with the Kaláus, this man could give no information, his pastoral wanderings having never extended into that quarter. But all the accounts given of that tract, which is tolerably well peopled, and frequently visited by the Russians, allow us to assume that the western Manech proceeds from the Kaláus, and that the latter, descending from the mountains, divides into two arms, the one flowing westward into the Don, the other, probably less, going eastward, and terminating in a lake not far from the Caspian Sea. This last particular will not surprise any one who is acquainted with the character of other rivers in the same region. We have in the Kuma, which is not far off, an example much to the purpose. This river, the banks of which are covered with villages and estates, is too

well known to travellers and to the natives to allow of our entertaining any doubt respecting the eastern part of its course. In spring the traveller is obliged to cross between the stations Kumskaia and Guiduk, on the postroad to Astrakhan, the branches by which it discharges itself immediately into the Caspian Sea, and when we passed that way at the end of January, we found in one of those great branches a pool of shallow water, some fathoms wide, which was frozen; but in hot summers these outlets dry up completely, and then the Kuma terminates in a lake from seven to ten miles in circuit, and called Yarligor; nor does it pour its superfluity into the Caspian until replenished by the melting of the snow on the mountains, or the continuance of heavy rains. The water of this lake is fresh like that of the Kuma.

Moreover, at the post-station of Guiduk I received from an aged and respectable Kalmuk, who had himself seen what he stated, express confirmation of the fact that the eastern Manech proceeds from the Kaláus, and falls into a lake here called Koikossú. The same man related also that, when young, he had heard old people say that the Manech once flowed into the Caspian Sea; and he added that, near Beloserk, the next station north from Guiduk, we should see the old bed of the river, and, perhaps, might remark also a bridge over it, which turned out just as he stated. We found there a small winding bed of a stream with a new bridge over it. This trace of a rivulet proceeds from the neighbouring lake of Belosero, which is filled with bitter water, and is probably a remnant of the former outlet of the Manech, now choked up by the shifting sandhills of this region.

When, after concluding our levelling on the Manech, we turned southward towards Caucasus, we

came on the Kaláus at the end of 25 or 30 miles; but we had no suspicion then of what I afterward learned respecting this remarkable river, otherwise I should have laid much stress on being able to visit the point where it joins the Manech. It flowed with a rapid stream northward in a winding bed, cut to the depth of 40 feet in hard sand and loam; about 30 miles higher up, in a mountainous tract near Petrovsk, we found it already a few fathoms broad, and running rapidly in a deep bed.

If the preceding account of the relation subsisting between the Kaláus and the Manech be correct, which to me seems hardly doubtful, then the distribution of the rivers in the low country north of Caucasus takes a peculiar and interesting form; for a mountain ridge extends downward from Elbruz towards Stavropol, and in its whole extent northward, where for a long distance it forms a scarcely perceptible elevation of the ground, it constitutes a line of partition between the waters of the Black Sea and of the Caspian. From the high mountains issue, in the first place, the Kuban and the Terek, the sources of which are not far asunder, and rush as great streams in opposite directions, the former to the Black, the latter to the Caspian Sea. Next we see the great Yegorlik and the Kuma going forth in opposite courses, the former lower down, running into the Don as the Western Manech, the latter flowing into the Caspian Sea, or disappearing in the steppe. In the third place comes the Kaláus, which, lying lower down in the steppe, diverges at once to the west and east, running westward through the long lake of the Manech into the Don, and eastward into the Little Manech, which is lost in the sands of the steppe. Fourthly and lastly, we see also the Sal flowing westward into the Don, and, towards the east, the

rivulets of the steppe uniting in the Sarpa, which discharges its waters through the Volga into the Caspian Sea.

But, however remarkable and well-authenticated the preceding description of the Manech may be, it is not yet calculated to settle the question respecting the difference of 300 feet between the levels of the Black and Caspian Seas, and I therefore felt more strongly the necessity of endeavouring to solve that problem by a complete barometrical measurement from the one sea to the other.

Prior to this, Professor Engelhardt also had expressed to me his ardent wish to have, for the purposes of his geognostical speculations, a levelling of the lower portions of the Don and Volga; and he added, at the same time, that as these rivers, about 270 miles above their mouths, approach within an inconsiderable distance of each other, the heights of the two seas might be easily deduced from the levelling between the rivers. The execution of this plan seemed to me to be of great importance; and in the winter season, when we were returning, it was rendered easy by the frequency of the post-stations on the line of our operations. M. von Behaghel was my coadjutor in this station measurement, which was carried on by contemporaneous observations from Astrakhan, where the Volga may be said to have the same level as the Caspian Sea, along that river 265 miles up to Zarytzin, then northwestward 42 miles across to the Don at Kachalinsk, and thence 275 miles down that stream to Old Cherkask, where, in like manner, the fall may be said to terminate.

This entire distance of 582 miles was divided into thirty-three barometrical stations, the average length of which was consequently $17\frac{1}{2}$ miles—too great a length, certainly, to afford security against

the errors likely to arise from difference in the states of the atmosphere at the points of contemporaneous observation. But the attempt to divide these stations might have easily occasioned still greater errors, or a loss of time which could not be compensated in the middle of winter; and, moreover, the uniform steadiness of the winter's cold favoured our undertaking in such a way, that I am under no apprehension of any considerable errors from this source.

The first barometrical station was on the Volga itself, a foot and a half above the ice of the river; the succeeding stations followed the course of the stream; and at Zarytzin, the observation was made two feet above the ice. We thence turned westward on the postroad, across a ridge of hills into the valley of the Don, at the post-station of Kachalinsk, and from this place we followed the road which goes along the river down to Old Cherkask, where the last observation was made 15 feet above the level of the river. The stations at Astrakhan and Old Cherkask were, in reality, from 20 to 32 miles distant from the shores of the adjacent seas; but this need not prevent our assuming that the first and last observations were made at the levels of those seas, since it is manifest, from the ramifications of the rivers Don and Volga at their mouths, that there is, in fact, no fall below the places where we observed, and that the continuance of the current is attributable only to the impetus derived from the fall higher up.

The steady, though very slow decrease of the Caspian Sea for the last half century is proved by two undeniable facts, which are familiarly known to every one in Astrakhan. First, the canal which leads through the town, and is connected above and below with the Volga, was 2 or $2\frac{1}{2}$ feet deeper fifteen

years ago than it is at present; secondly, there is a large piece of ground now built upon in the town, which forty years ago was covered with the waters of the Volga, and where ships used to lie.

Our series of observed heights, when summed up, furnishes this result, that the mouth of the Don lies about three feet eight inches lower than that of the Volga; and as, in levelling with the barometer over so extensive a tract, exactness within a few feet is not to be thought of, the true conclusion is, *that between the Black and Caspian Seas there is no considerable difference of level.*

Whoever is aware of the influence exercised by the weather on barometrical measurements, particularly when there is a considerable horizontal distance between the stations of observation, will not expect that our levelling should represent perfectly the fall of the Volga or the Don. The fall of the former of these rivers particularly, which is extremely sluggish in its course, could hardly be supposed to be detected with certainty at each station; yet our measurement appears in this point of view to possess an unusual degree of accuracy: for the fall of the Volga from Zarytzin to Astrakhan, a distance of 265 miles, it gives 51 feet; for that of the Don, from Kachalinsk to Old Cherkask, 275 miles, 225 feet. This corresponds with the reality; for every inhabitant of those countries knows that the Volga is a much slower river than the Don, though not in the proportion of the falls above indicated; because the waters of the Volga, which is the larger river, have a greater momentum than those of the Don.

The coincidence between the fall which our calculations assign to the Volga, and that found contemporaneously and by a most careful measurement for the Ural, which river also runs into the Caspi-

an Sea, is very remarkable. The course of the Ural was levelled by M. Hofmann and Von Helmersen,* who found that from the Fort of Girgalskoi to the Caspian Sea, a distance of 470 miles, the fall of that river was but 90 feet: at this rate, 265 miles would give 50 feet, which is just what we found for the fall of the Volga in that distance.

It appears also from our observations that in both rivers the lower part has less fall than that which is higher up, which is natural enough. If, on the other hand, it is indicated also that the highest part observed had a weaker fall than the middle portion lower down, this must not be considered at once as the consequence of some error, for such was the case with both rivers, and with each in proportion to its whole fall. It is more likely that such inequality actually exists, and that it is connected with the windings or elbows of the rivers occurring in those places. In fact, I did not expect to find in the results of this portion of our labours so strong a proof of their accuracy, and therefore I am the more inclined to put quite as much faith in them as in the levelling between both seas executed in 1811 on the Caucasian lines. Consequently, the proposition formerly advanced by me, "that the Caspian Sea lies about 300 feet lower than the Black Sea," must be considered as refuted, however flattering it might be to myself to be able to maintain the contrary. But what higher object can the philosopher or student of nature have in view than truth? and what can the learned world, whose confidence and approbation he seeks, ascribe to him of more importance than truth? We are always ready to contend against the doctrines and discoveries of others; why should we

* Geognostic Researches in the Southern Uralian Mountains (German), p. 82.

find so much difficulty in an impartial review of our own labours?

After this explanation, it may not, perhaps, be thought foreign to the purpose if we cast an eye on the country round the Manech, which separates the Black Sea from the Caspian, and which has, probably, served for the connexion of those seas, if it be admitted that such connexion ever existed.

First of all, the possibility of such a connexion between the two seas at some remote period, and of its continuing longest and latest in this very line, was fully proved by our barometrical measurement, from which it appears that this whole region is very low, rising nowhere more than 100 feet above the level of the Black Sea, and the river itself having a very trifling fall of an inch and a half per mile, while the eastern end of the great Manech lake is at the utmost but 24 feet above the level of the Black Sea. But that the country farther eastward, towards the Caspian Sea, has not a different character, is manifest from the accounts which show that the Manech either takes its rise from a small lake about 50 miles from the low and marshy shores of the Caspian Sea, and flows as a slow and feeble tributary to the Kaláus, or else, which is more likely, that it issues from the Kaláus. This river, according to the latter statement, descending from the foot of Caucasus, divides into two rivers, called Manech, the one running westward till it joins the Don, the other eastward into a small lake, of the former connexion of which with the Caspian Sea traces still remain, as has been already stated; from all which it may be safely concluded that the eastern tract, which was not visited by us, must be also very low, and certainly cannot have an elevation of 100 feet above the sea.

It is farther to be remarked, that the deepest

place, and, consequently, the line of the former connexion between the two seas, is to be sought along the bed of the Manech, and not farther either to the north or south; for in the latter direction the country rises very perceptibly towards Caucasus, as is shown by the northerly course of the rivers through it; and on the northern side of the Manech, exactly opposite the place where the Kaláus is said to divide into two branches, is a chain of hills, which, at the Kossak post of Verkhnoi Kamennoi Rordon, on the borders of the Don-Kossak and Astrakhan governments, about 20 miles from the Manech, attain a height of 400 or 500 feet, and thence extend northward between the Sarpa and the sources of the Sal. The Manech therefore marks the line of greatest depression between the Black and Caspian Seas, and may be regarded as a sort of canal, or as the last drain of a communication, for the re-establishment of which it would be necessary only that the Black Sea should rise 24 feet above its present level.

To these reasons for admitting the possibility of a former communication between these two seas, which lingered longest in the steppe of the Manech, are to be added some arguments derived from the physical constitution of the soil, and tending to prove the verisimilitude of that hypothesis.

New Cherkask lies 300 feet above the level of the Black Sea, on a plain which terminates near the town in cliffs or steep banks, where the predominant rock is fully exposed. This is a friable shell-limestone, similar to that which is found at Odessa and other places on the shores of the Black Sea, lying in horizontal strata, as may be concluded from the layers of clay and sandstone associated with it. This same shell-limestone, of like composition and stratification, we find *in loco* at

three different points in the steppe of the Manech, from which circumstance several of the Kossak posts have obtained the name of Kamennaya, the appearance of rock (in Russian, *Kamen*) being in this tract, as in the steppes generally, something unusual.

The deposites of salt, to which the waters of the Black and Caspian Seas owe their saltness, may be supposed, in like manner, to lie at a certain depth below the shell-limestone, and probably to extend from the one sea to the other; for otherwise how shall we account for the number of salt-lakes, great and small, about the Manech and onward as far as the Caspian Sea, particularly in the neighbourhood of the great Manech lake, where the quantity of salt annually collected is so great that the army of the Don is satisfied with receiving a tenth part of the produce? Or to what shall we ascribe the saline efflorescence so abundant on the surface of the ground in the steppe of the Manech? Or how shall we account for the saline plants in the middle of this steppe, some hundred miles distant from the sea, unless we admit that the rocks, which form the foundation and bottom of the Black Sea, extend uniformly through the lowland as far as the Caspian Sea, and have been left dry in this slightly elevated tract only by the retiring of the waters? And how can the impression that this region was once submerged be effaced from the mind of any one who will take the trouble to compare the constitution of its surface on the whole with that of any spot which has been for some time under water, and exhibits a soil of mixed sand and alluvial earth? We find here a flat country, extending sometimes in perfectly level plains, at other times with a surface resembling waves, according as the waters which fashioned the land and moulded it into its

present form were calm or tossed by storms. On the shores of the Caspian Sea, exactly where the retiring floods may be supposed to have last directed their movements, we find chains of downs of fine sand lying for the most part in an easterly and westerly direction, and containing in their hollows innumerable fragments of common seashells.

LEVELLING FROM TIFLIS TO THE SHORE OF THE BLACK SEA.

At the outset of our journey from Tiflis to Redoute-Kaleh, the observations on the first stage to Gartiskar were prevented by the rapid fall of night, and the same thing happened again on the station from the farmhouse to Sakharbetsk; but both these distances were carefully and effectively levelled on our return. In calculating by La Place's formula, I assume the latitude of this tract to be 42°.

The weather was on the whole favourable, without great changes, the sky generally clear, and the air in gentle motion. It rained rather heavily only on the stage from Maransk to Abashinsk, and also between Sakharbetsk and Redoute-Kaleh. The whole distance over which our observations extended amounts, according to the estimates of the Kossaks stationed in the country, corrected by my own experience as to the distance gone over in an hour with a certain mode of travelling, to 228 miles. This being divided into nineteen barometrical stations, gives to each an average length of 12 miles. Our observation at Redoute-Kaleh was made eight feet above the level of the sea. On leaving that place, our stations were as follows:

	Feet above the Sea.
Khorginsk	17
Sakharbetsk	52
Mingrelian farmhouse	46
Abashinsk	31
Maransk	25
Gubizkali	153
The post-station in the town of Kutais, 37 feet above the Rion	438
Chelabursk	358
Quirilofsk	476
Sakarabedsk	1351
Goreloi	1026
Maliti	1613
Town of Suram	2273
Gargarebsk	1971
Town of Gori, six feet above the river	1855
Chalsk	2323
Mukhran	1571
Gartiskar	1501
Stone bridge over the Kur in Tiflis	1173

Not far from Suram is the mountain ridge which divides the waters of the Black and Caspian Seas; where we crossed it, it was 710 feet above Suram.

The station on the bridge in Tiflis was 32 feet above the surface of the water in the river at that time (21st of December, old style); consequently, this river, in a course of 300 miles, has a fall of 1141 feet.

LEVELLING FROM TIFLIS TO ARARAT, AND IN THE ENVIRONS OF THE LATTER.

The chief portion of this work was the line from Tiflis to Echmiadzin, a distance of 155 miles, in which the road led over three lofty mountain ridges, Agsböük, Besobdal, and Pambak. With respect to contemporaneousness, we were, with little exception, scccessful in our observations. The whole line was divided into twenty stations, the average interval between which was consequently less than eight miles—an extremely favourable distance. 40° 43′, the mean between the latitude of Tiflis and that of Ararat, was assumed as the latitude of the tract levelled. The weather was generally favourable during our operations: it was not till we reached the last station but one from Echmiadzin

that a storm came on, which ended in heavy rain a few hours after the conclusion of our labours. Our residence in Tiflis, where our series of observations commences, was 92 feet above the bridge over the Kur:

	Feet above the Sea.		Feet above the Sea.
Tiflis	1265	Kishliak	4541
Teleti station	1771	Hammamlüh	5033
Kodi	1824	Pambak, 10 feet below the summit of the ridge	7828
Station on the road, 5½ miles farther	1514	Kossak post	6567
River Khram, three feet above the water	1069	Quarantine station in Bash-Abaran	6321
Shulaver	1708	Hill, 7½ miles farther	6422
Sametzk	3449	Foot of an isolated mountain, 7½ miles farther	6216
Slope of the Agsböük	4675	Station, 13 miles from Echmiadzin	4212
Agsböük station	5273	Monastery of Echmiadzin	3055
Jallal Oglü	4527		
Gerger	4753		
Besobdal	6680		

The station in Echmiadzin was in the court attached to the habitation of the patriarch and higher order of ecclesiastics, and may be considered as having the same elevation as the spot on which the Cathedral stands, the whole ground being perfectly level. To the foregoing connected series of levels are attached several barometrical measurements of heights, which, proceeding from determined points of it, are to be regarded as its continuations. In calculating the foremost of these supplementary heights, the same co-efficient of latitude has been assumed as in the preceding series; the measurements on Ararat and in its vicinity have been calculated for latitude 39° 45′ 56″.

BAROMETRICAL STATIONS.

	Feet above the Sea		Feet above the Sea.
Ridge of Agsböük	5,818	Kanakir	4,421
The Araxes, 2 feet above the water	2,900	Night-station on Ararat (Sept. 12)	12,446
Monastery of St. James	6,375	Eastern ice-slope of Ararat	15.408
Erivan, the highest part of the town	3,529	Limits of snow	13,902

	Feet above the Sea.
Kip-Ghioll on Ararat	11,577
Limits of snow	12,624
Night-quarters on Ararat (Sept. 19)	13,159
Limits of snow	14,334
The Great Cross	16,134
Summit of Great Ararat	17,325
Summit of Little Ararat	13,093
Birch wood on Little Ararat	8,301
Trigonometrical base	2,919
Magnetic rocks	7,329

The agreement between the height of the Araxes and that of the trigonometrical base, the former being 2900, the latter 2898 feet above the sea, is a proof of the exactness of the barometrical measurement; for the two places must be nearly on the same level, the trigonometrical base-line being selected in the plain of the Araxes, near some villages through which the streams called the Blackwater take their course. These rivulets are, in fact, nothing more than side-drains or lateral canals of the Araxes, above which the plain nowhere rises more than a few feet.

It is of essential importance, moreover, to institute a comparison between the trigonometrical and barometrical determinations of the height of Great as well as of Little Ararat. From the results of the barometrical measurement given above, it appears that the summit of Great Ararat rises above the trigonometrical base in the valley of the Araxes 3433+10,876=14,309 feet. M. Fedorov makes the elevation of the highest point of Great Ararat to be above the base-line 14,114 feet, or 195 feet less than the preceding.

According to my observations, the elevation of Little Ararat above the base-line is 3433+6673= 10,106 feet; but, according to the trigonometrical measurement, it is only 10,051 feet; difference, 55 feet.

The well-known accuracy of M. Fedorov, together with the revisal of his calculations by Professor Struve, affords such a security for the correctness of the trigonometrical measurement as to negative

at once the supposition of an error occurring in it. On the other hand, I am unable to detect anything in the barometrical measurement which can satisfactorily account for the difference between us of 195 feet in the case of Great Ararat. However, I recollect that on the summit of that mountain, the mercury in the barometer stood so low that I could not push the index with the nonius down to it; yet the scale went still lower, and it was not difficult for me to read off, and mark the height of the mercury, measuring by the eye, so that I might be sure of not erring above a quarter of a line, though even this amount would have argued great want of skill. Such an error, nevertheless, would account for only a fifth of the difference between the two measurements; and yet to have exceeded it may be regarded as impossible.

BAROMETRICAL LEVELLING OVER THE CROSS-MOUNTAIN BY CONSECUTIVE OBSERVATIONS.

Undoubtedly the only barometrical determinations of height which can be fully trusted are those derived from corresponding or contemporaneous observations; yet, in cases where these cannot be made, in interesting countries, there is another mode of measurement, which is not to be despised merely because less certain in its results than the preceding, though it is at all times more accurate than the usual method by means of quite independent and isolated observations: I mean that mode by which an observer, noting the state of the barometer at the several points on his road, treats the observations made from station to station on the same day as a series of corresponding ob-

servations. Such a measurement involves, of course, the errors arising from changes of weather, not including, however, the changes which take place during the night, or those which extend over a single day; and if one were so fortunate as to observe on days when the stationary barometer undergoes little change, this method would admit of considerable accuracy, as I first tried in levelling Mount Rosa, and subsequently in the Pyrenees, and in both cases offered decisive proofs of the correctness of the results. Moreover, the measurement, which is here the subject of discourse, owes some importance to the circumstance of its embracing the famous Cross-Mountain, the central ridge of Caucasus, of which travellers write and say so much, but respecting the actual height of which nothing de terminate has been as yet made known.

BAROMETRICAL STATIONS.

	Feet above the Sea.		Feet above the Sea.
Kobi	6452	Monastery of Ananur	2686
The Cross on Cross-Mountain	7945	Gartiskar	1580
Mount Guda	9030	Tiflis (place of residence in)	1234
New Keshour	5760	Bridge on the Kur	1172
Passanour	3480		

The height of the bridge on the Kur I have taken from the great levelling to the Black Sea, and have determined the other points from it. The place of observation in Gartiskar was different from that made use of on a former occasion; hence the difference between the two determinations of the height of that place.

On my return in winter, I again made an observation on Mount Guda on the 2d of January, and also at Kobi, but at a place 20 feet lower than the summer station: these observations make the difference of elevation between the two places, or the height of Mount Guda above Kobi, to be 1560 feet;

the observations made in summer give 1567 feet—a remarkable instance of agreement!

TEMPERATURE OF SPRINGS.

As a single glance at a barometer goes but a short way towards determining the elevation of a place above the level of the sea, so we must not flatter ourselves that we can satisfactorily answer the important questions which arise respecting the mean temperature of the earth in any locality merely by dipping a thermometer in the first good spring as we pass along, or into a bucket of water drawn from the nearest well.

This consideration, however, does not relieve the rational inquirer, who takes an interest in the phenomena of the interior of the earth, from the duty of devoting some attention to the temperature of springs, which, partly as the result of merely local causes, is not without its importance in the natural history of the earth; but partly, also, as the subject of an extensive and varied comparison, from which may be deduced the law of the distribution of heat throughout the globe, is well deserving of the closest study.

I have invariably taken the precaution to examine the springs immediately at the place where they issued from the earth, and that with a very sensitive thermometer, the bulb of which measured $1\frac{3}{4}$th inches in diameter, while the degrees on the scale were each $\frac{3}{4}$ths of a line in length. As the freezing point in the thermometer is liable to change, I tested mine in this respect, and took the result into calculation. The altitudes above the sea assigned to the springs are partly founded on exact barometrical measurements, partly on estimates derived

from the nearest determined points. The possible errors of such estimates being stated, the reader is himself in a situation to judge of the value of the observation.

1. On the 17th of May, 1829, I found in the steppe of the Kalmuks, north of Caucasus, and near the Manech, in latitude 47° N., longitude 59° E. from Ferro, and 114 feet above the level of the sea, a perfectly clear and well-tasted spring of water, with a temperature of 13° centigrade.*

2. On the 23d of May, in the same region, not far from the great lake of Manech, near Verkhnoi Kamennoi, I found, in a hilly district, in 46$\frac{1}{3}$° N. lat., 61° E. long., and 420 feet above the sea, several springs issuing from a loamy soil. In two of them I was able to observe the temperature at their very origin, and found in both cases 13° C.

3. From Yekaterinograd, on the Terek, the military road over Caucasus leads first through a wide plain, the bounds of which are scarcely visible. On this plain, 12 miles south of Yekaterinograd, in lat. 43$\frac{2}{3}$° N., long. 62° E. from Ferro, and 825 feet above the sea, a spring, issuing from the level ground, had on the 29th of May a temperature of 13°·6 C.

4. On the 2d of June, I found on the road over Caucasus, two miles north of Lars, in lat. 42$\frac{3}{4}$ N., long. 62° E., and about 2850 above the sea, a spring issuing from the clay-slate on the left side of the valley of the Terek, with a temperature of 13°·7 C.

5. At Lars itself, 3150 feet above the sea, on the

* The degree of the centigrade scale exceeds that of Fahrenheit's in the proportion of 9 to 5; consequently, if from the double of any given number of centigrade degrees we subtract the tenth of that double, we have the number of the degrees of Fahrenheit's scale above the freezing point, to which 32 are to be added tc reach the zero of that scale. Thus 13° cent. equal 26—2·6=23°·4, to which 32° being added, gives 55°·4 Fahr.

2d of June, a spring from the clay-slate showed 8°·6 C.

6. On the 3d of January, when returning, I found, close to the road, about four miles north of Stepan Zminda, in lat. 43° N., long. 62° E., and perhaps about 1350 feet above the sea, two springs close together, with a temperature of 9° C.

7. On the 2d of June, 1829, three miles north of Stepan Zminda, 4500 feet above the sea (200 feet more or less), a spring issued from the foot of the high cliff at 7°·4 C. On the 3d of January I found the temperature of the same spring to be 6°·1 C.

8. On the 2d of June, two miles north of Stepan Zminda, about 4750 feet above the sea (200 feet more or less), also at the base of a high rock, was a spring with a temperature of 10°·4 C., and another, a few paces distant, with 11°·1 C.

9. On the 2d of June, a mile and a half north of Stepan Zminda, about 5000 feet above the sea (200 feet more or less), was a spring at 6°·5 C.

10. On the 3d of June, 450 feet above Kobi, 6850 feet above the sea, on the road to the Cross-Mountain, was a spring at 3°·2 C.

11. On the 3d of June, near No. 10, but 60 feet deeper in the bed of the river, there issued, quite close to the water of the stream, and necessarily, at times, overflowed by it, a spring of very agreeable acidulous flavour, containing salts of sulphur and iron, with much force from a round hole, about two inches in diameter, in the horizontal limestone. Its temperature was then 5°·4 C. On our return, in January, I found it flowing with the same strength and copiousness, but with a temperature reduced to 4°·6 C.

12. The 3d of June, on the same road, 840 feet above Kobi, 6600 feet above the sea, occurred a saltish spring, which, judging from its taste and

from the absence of reddish depositions near it, contained but little iron or sulphur. Its temperature was 7°·5 C.

13. On the 1st of January, 1830, about half way between Keshour and Passanour, on the southern side of Caucasus, on the bank of a little rivulet, about 4500 feet above the sea (120 feet more or less), was an acidulous spring, containing iron, and giving out great quantities of gas, with a temperature of 8°·6 C.

14. On the 4th of June, near Passanour, lat. 42⅓° N., long. 62⅓° E., and 3500 feet above the sea, a clear spring of pure water issued from a soft, loamy soil at 10°·9 C.

15. 4th of June, south of Passanour, 3250 feet above the sea, a spring of pure water at 11°·1 C.

16. 4th of June, south of Passanour, 3150 feet above the sea, a spring of pure water at 12°·4 C. At the distance of two feet from it was another spring at 15°·5 C. They were both only about three paces from a rivulet.

17. 4th of June, south of Passanour, 2820 feet above the sea, were two wooden troughs, 12 feet long, for two springs, which had, at the spot where they gushed from the clay-slate, a temperature of 10°·1 C. When I was returning, on the 31st of December, 1829, they had 8°·7 C. of heat, while the air was at zero.

18. On the 31st of August, 1829, I twice drew a bucket of water from one of the deepest wells in Tiflis, close to the Cathedral, 1200 feet above the sea, and found its temperature 15°·1 C. The well was very narrow, 23 or 24 feet deep, and was always covered with boards.

19. On the 11th of August, in Kakheti, between the villages of Yenisseli and Shakreane, lat. 42° N., long. 63° E., 1020 feet above the sea, a spring

of perfectly pure water, at the base of a mountain, had a temperature of 14°·2 C.

20. On the 11th of August, a furlong from No. 19, towards Shakreane, at the same elevation with it, was an acid, sulphureous spring at 15°·9 C.

21. At the same date, in Shakreane, 980 feet above the sea, a spring of pure water, rising from the sandy soil, had a temperature of 13°·6 C.

22. 21st of August. At the eastern end of the town of Telavi, in Kakheti, several springs gush out at the same place, but are conducted for some yards by wooden pipes sunk in the ground. Five of them had the following several temperatures: 13°·0, 12°·4, 12°·4, 12°·5, 12°·4; one alone could be examined at its very source, and its temperature was 12° C.

23. The 21st of August I found, at the opposite end of Telavi, on the road to Tiflis, a spring from the gravel hills, with a temperature of 12°·1 C.

On Ararat there are no springs but those fed by the melting ice of the snowy region; consequently I could not there make any observations on subterranean temperature.

MAGNETIC OBSERVATIONS.

The declinatorium, or instrument for measuring the declination of the needle, which I made use of, had a needle of fine hammered steel, $10\frac{2}{3}$ inches long, and resting, by means of an agate cap, on a fine steel point. The horizontal movement of the needle was measured on an arc divided to tenths of a line. The value of one of these in parts of a circle was doubly ascertained by the following methods: First, I measured the radius from the

point on which the needle moved to the divided arc, and found it to be 64·35 Parisian lines; the length of the circumference, being calculated from that of the radius, gave 5·3393 minutes for each tenth of a line. Secondly, the same angle being measured by the declinatorium and the theodolite, the comparison of the two measurements gave 5·3392 minutes for the value of the tenth of a line on the scale, which differs but 0·0002 minute from the result obtained by the other method.

In Dorpat, which lies in lat. 58° 23′ N., and long. 44° 23′ E. from Ferro, and 200 feet above the level of the sea, I found, on the 13th of March (old style), about five o'clock in the afternoon, the magnetic declination to be 9° 4′ 34″ W. On the 20th of March, at five o'clock in the afternoon, it was 8° 59′ 35″; and on the 23d, at four o'clock, 8° 59′ 23″. The mean of these three observations is 9° 1′ 10″ W. Probably the first of the three is entitled to less confidence than the other two, being made before I had become used to the instrument.

In Tiflis there was no better position for determining the magnetic declination than the firm, flat roof of the house we lived in, which was in lat. 41° 41′ N., long. 62° 34′ E., and 1270 feet above the sea. In order to ascertain whether, and to what extent, the needle was affected by the iron in the building, we compared together observations of angular distance made with the declinatorium and with the theodolite. We also collected all the iron that we could find in the chamber perpendicularly beneath, and 25 feet from the roof, and having thus observed the declination, we removed the iron 14 paces farther off, and repeated the observation. Both experiments showed that the iron in the building exercised no appreciable influence on the needle. This point being determined, we found the

declination at Tiflis, taking the mean of several observations, to be 3° 46′ 48″ west.

With respect to the hourly variation of the magnetic declination, I made, on the 28th of June, a series of observations, from which it appears that from seven o'clock in the morning till half past two in the afternoon the north pole of the needle moves uninterruptedly westward through an arc of about 12′ 37″, and then moves eastward till half past six in the evening. An anomaly apparent in its movement between five and six o'clock must be ascribed to some temporary disturbance.

At the monastery of St. James, on Ararat, the declination was observed on a little eminence about 70 feet high, the position being lat. 39° 42′ N., long. 61° 55′ E., and 6405 feet above the sea. On the 23d of September, at 11 o'clock in the forenoon, the magnetic declination in this place was 4° 28′ 53″·5.

I also observed the magnetic inclination or dip with a very delicate dipping needle, and found it to be, in Dorpat, from a mean of several observations, 70° 43′·15. In Tiflis the dip appeared, from the mean of observations made on the 3d and 5th of June, to be 55° 31′: observations at a later date made it 55° 37′; but as there was a storm at the time, the last result is less to be relied on than the preceding. In St. James's, on Ararat, I found the dip, on the forenoon of the 25th of September, 1829, and in the open air, to be 53° 7¼′; on the 5th of October, at four o'clock in the afternoon, and in the great portico of the stone church, it was 53° 6′.

OBSERVATIONS WITH THE PENDULUM.

An apparatus destined to make long journeys, and to be used in places and circumstances wanting in the accommodation required for accuracy of observation, ought to be constructed in the most simple and compendious manner possible. As soon, therefore, as I had come to the resolution to make pendulum experiments in the course of my journey, I directed my attention particularly to the best mode of giving the requisite apparatus a simpler form and greater facility of application than belong to the pendulum ordinarily used by travellers, yet without sacrificing the accuracy which is so essential, when, from the minute phenomena of an oscillating pendulum, we would arrive at conclusions respecting the form, the mass, and the moving forces of the globe.

My apparatus is a constant pendulum, with which, consequently, the object of observation is not the length of the pendulum, but the time of oscillation. It was made by Brücker, of Dorpat, under my own direction, and is wholly of brass; the axis, however, is of hard steel, and rests with its edge on two plates of chalcedony, formed with a convex surface, so that the steel edge touches only a small portion of them. When this apparatus is arranged for use, the clock is so placed above that the seconds-pendulum belonging to it (the rod of which is made of fir saturated with oil) hangs about three inches in front of the constant pendulum. The rate of oscillation of the latter is then determined by observing its coincidences with the seconds-pendulum, which is done in the following manner:

The two pendulums and whole apparatus are protected from sudden changes of temperature and

from currents of air by a light case, one side of which is made of wood, the other three of paper, fastened on a slender frame of thin iron. In the front of this case, immediately opposite to the terminations of the pendulums when they hang vertically, is a small hole for the eye of the observer, which is thus confined to a fixed position. Between the two pendulums is a screen of pasteboard, with a small hole in the middle, and in the same horizontal plane with that intended for the observer's eye; the seconds-pendulum in front also carries a narrow screen, with an aperture in the middle. The constant pendulum behind the screen has a white card attached to it, the passage of which over the aperture in the middle screen appears to the observer like a flash of light; but it is obvious that this can be seen only when the seconds-pendulum passes the line drawn from the observer's eye through the aperture in the middle screen at the same moment as the constant pendulum: the appearance of this flash of light therefore marks the coincidence of the two pendulums.

It may be easily conceived that so simple an apparatus, with a pendulum only two feet long, can give but little trouble in setting it up, observing, packing, and carriage; and, in truth, mine, after a journey of 4700 miles, and twice across the rugged heights of Caucasus, on a carriage without springs, bears not the slightest trace of an injury, and when unpacked, it may be arranged for use within an hour. As to the results which it is capable of furnishing, they may be best appreciated from the discussion of my observations.

My respected colleague, Professor Struve, who took from the beginning the most lively interest in my scientific undertakings, and has rendered them the most essential service in various ways, has taken

the trouble to calculate my pendulum observations, and has contributed the following paper to this volume:

ON THE PENDULUM OBSERVATIONS MADE BY M. PARROT, IN DORPAT, TIFLIS, AND ON ARARAT.

(*By Professor Struve.*)

The extremely convenient and accurate pendulum apparatus above described consists essentially of a constant pendulum, the oscillations of which are compared, by coincidence, with those of a clock-pendulum. Six series of observations were made with it. The first two series were observed in Dorpat previous to the journey, from the 17th to the 25th of March, 1829, at very different temperatures of the apparatus. The comparison of these sets of observations with each other was calculated to give the effect of heat on the time of oscillation with greater certainty than any deductions made from the assumed dilation of the mass. In the course of the journey experiments with the pendulum were twice made; first in Tiflis, south of the mountain-mass of Caucasus, from the 1st to the 8th of July, 1829. Tiflis is sufficiently distant from Caucasus to allow us to consider the oscillations of the pendulum observed there as uninfluenced by the mass of that mountain range. Afterward a series of observations was made on the side of Ararat, from the 12th to the 18th of October, 1829, at a height of 6000 feet or more above the sea. In latter times, experiments with the pendulum have been, as far as I am aware, but seldom made at a considerable height above the level of the sea.

The experiments of M. Parrot possess, therefore, a high degree of scientific interest, which will increase when it is considered that the isolated situation of Great Ararat and its elevation above the surrounding plain fit that mountain in an es-

pecial manner to furnish us with conclusive results respecting the disturbance or change of gravitation caused by the proximity of mountain masses. In order to test the unaltered condition of the constant pendulum, M. Parrot made his fifth series of observations after his return to Dorpat, from the 27th to the 31st of March, 1830, in the same place in which the first series was made.

The observations made in Dorpat in 1829 were calculated by me immediately after their completion. This was necessary, in order to ascertain that the mode of observing was satisfactory, and to estimate, in a general way, the capabilities of the apparatus. It was in February, 1833, that I was first called upon to calculate the observations made during and subsequent to the journey. I then perceived, on closer inspection, that the series of observations made in Dorpat in 1830 differed essentially from all the other series, inasmuch as in it the observations were made only three times a day, viz., morning, noon, and evening, whereas in all the others the oscillations of the constant pendulum were compared with those of the clock pendulum at midnight also. In consequence of this oversight, the series of 1830 was rejected as insufficient, and instead of it a new series, in conformity with the rest, was made from the 28th to the 31st of March, 1833.

The oscillations of the constant pendulum were observed by comparison with those of the pendulum of a clock, the rate of which was again checked by comparison with a chronometer, or by astronomical observation. It was thus easy to ascertain how many beats the pendulum made in a mean day. The irregularities arising from variations in the arc of vibration, and in the length of the pendulum caused by change of temperature, were all

observed and corrected by calculation. The various sources of error being thus carefully watched and obviated, the pendulum experiments of M. Parrot yield the following results.

	Lat.	Absolute Height.	Vibrations.
Dorpat	58° 22′ 54″	152 feet	110,921·22
Tiflis	41° 41′ 27″	1250 "	110,829·88
Ararat	39° 46′ 12″	6312 "	110,799·46

The numbers here given in the last column represent the vibrations of the pendulum in the mean day, not, however, as they were actually found by experiment, but corrected for the resistance of the air and change of temperature, or, in other words, reduced to the number of vibrations *in vacuo*, and at the temperature of 16° cent. (60°·8 Fahrenheit). They may be rendered still more susceptible of comparison by being reduced to the common level of the sea. This being done, we have, for

Lat. 58° 22′ 51″, A=110,922·03
— 41° 41′ 27″, B=110,836·59
— 39° 46′ 12″, C=110,833·20

From these data, an attempt may be made to deduce the polar depression or oblateness of the earth; and, indeed, they allow of a twofold mode of proceeding, by comparing A first with B, and then with C.

1. The comparison of Dorpat and Tiflis gives for the oblateness, or diminution of the polar diameter, $\frac{1}{312\cdot5}$.

2. The comparison of Dorpat and Ararat gives $\frac{1}{279\cdot3}$.

The first of these expressions agrees very closely with the most probable result derived from all the measurements of degrees known up to 1832, and which, according to Schmidt,* amounts to $\frac{1}{302}$, so that M. Parrot's experiments in Dorpat and Tiflis give a remarkably exact value of the earth's ob-

*Astronomische Nachrichten, No. 213.

lateness. That the comparison of Dorpat and Ararat should give a result differing widely from the preceding was to be expected, inasmuch as the gravitation on Ararat at the height of 6000 feet cannot be considered as quite independent of the mountain mass.

But, instead of deducing the polar depression from Parrot's experiments, we shall find it more important to examine how closely the gravitation observed by him in Dorpat and the two other places agree with that derived from the most careful pendulum experiments made hitherto. Schmidt has shown,* from all the pendulum experiments of any value known in 1829, and taken together, the law according to which the length of the seconds pendulum is modified by the latitude. Knowing the length of the seconds pendulum, and how it varies between the pole and the equator, we can easily deduce, in conformity with the same law, the variable oscillations of a constant pendulum; if, therefore, the number of vibrations in the mean day in Dorpat were (as calculated above) 110,922·03, we find

	Calculated.	Observed.	Difference.
For Tiflis	110,841·02	110,836·59	—4·43
For Ararat	110,831·49	110,833·20	×1.71

These differences added together make —2·72; the mean difference therefore is —1·36 oscillation, or $\frac{1}{80000}$ of the whole number of oscillations. If we confine our attention to the observation made in Tiflis, the difference will then be nearly $\frac{1}{25000}$.

This leads to a highly interesting result, namely, that the observed proportion of gravitation in Dorpat, in Tiflis, and on Ararat, differs in the mean only about $\frac{1}{40000}$, or, considering Tiflis alone, about $\frac{1}{12500}$ from that derived from all the previous experiments with the pendulum. The previous pen-

* Lehrbuch der Mathem. und Phys. Geographie, vol. i., p. 381.

dulum experiments were nearly all made in the vicinity of the ocean. Caucasus and Ararat lie nearly in the centre of gravity of the old Continent, consisting of Europe, Asia, and Africa. We are therefore justified in concluding that the variation of gravitation on the surface of the earth, in the interior of the old Continent, is almost exactly the same as that which has been hitherto observed in the vicinity of the ocean.

Let us now compare the gravitation in Tiflis with that on Ararat. From the number of oscillations in the former place, =110836·59, we find

For Ararat, by calculation =	110827·10
The number observed =	110833·20
Difference -	+6·10

Thus it appears that the pendulum on Ararat made +6·10 more oscillations than was to be expected from the observations in Tiflis, or gravitation on Ararat showed an increase of $\frac{1}{9085}$. This increase of gravitation, though very minute, cannot, considering the exactness of the observations, be ascribed to error, the limits of which could hardly have exceeded two oscillations. We must therefore recognise herein the influence of the mass of the mountain on the pendulum.

The base of Ararat lies about 2900 feet above the level of the sea; the site of St. James's is about 3440 feet higher than that base, while the summit of the mountain rises 14,300 feet above it. The whole mountain mass above the basis has the figure of a cone, the mean density of which is estimated by M. Parrot at 2·3. It is now required to determine the amount and direction of the attraction of a cone on a point situate upon its inclined surface. Leaving to geometricians the strict solution of this problem, we shall suppose, for the sake of approximation,

that the mass of the cone is all united in its centre of gravity. On this hypothesis, we find the direction of the mountain's attraction to be towards the centre of gravity, $\frac{14300}{4}=3575$ feet above the base, or nearly at the same height as the monastery of St. James, where the experiments were made. It thence follows that the amount of the gravitation at St. James's could hardly have been affected by the mountain between the base and the summit, while the change in the direction of gravity was probably inappreciable. The augmented gravitation, indicated by the observed 6·10 oscillations, must be therefore ascribed to the influence of the mass, 2900 feet in thickness, between the base of the cone and the level of the sea.

M. Parrot has recognised the volcanic origin of the rocks found on Ararat: that mountain, therefore, must have been once an active volcano. If we suppose volcanoes to be hollow, it will follow that gravitation diminishes on them. But the increase of gravitation observed by M. Parrot in the monastery of St. James contradicts the supposition of extensive hollows beneath Ararat.

EXTRACTS FROM M. FEDOROV'S ASTRONOMICAL AND TRIGONOMETRICAL OBSERVATIONS.

The instruments employed by M. Fedorov on this journey were an eight-inch theodolite by Ertel, a seven-inch sextant by Troughton, a thirty-inch telescope by Dollond, and two chronometers —one, which was excellent, by Arnold, the other by Magnin.

The place of observation in Tiflis was the house of the merchant Khakhutof, in the upper part of

the town, a little to the south of the Catholic church. Here, the mean of several observations gave for the latitude, 41° 41′ 27″·4 N. The longitude found by various methods was 44° 50′ 39″ E. from Greenwich.

On Ararat, the latitude obtained for the monastery of St. James was 39° 46′ 12″; the longitude, 44° 21′ 53″ E. from Greenwich. By combining trigonometrical with astronomical observations, the following points were also determined:

	Latitude N.	Long. E. from Greenwich
Summit of Little Ararat -	39° 39′ 10″·68	44° 24′ 35″
Foremost summit of Great Ararat - - -	39° 42′ 24″·17	44° 17′ 53″
Hinder summit - -	39° 42′ 21″·94	44° 17′ 38″
Village of Bayat - -	39° 52′ 38″·78	44° 31′ 5″
Summit of Alaghes - -	40° 31′ 35″·65	44° 11′ 23″

The elevation of the plain in which the trigonometrical measurements were made was ascertained by M. Parrot, by barometrical observations, to be 2582 feet above the level of the Black Sea: this being added to the results of trigonometrical observations, gives the following absolute heights:

The foremost summit of Great Ararat - -	17,002 feet.
The hinder summit - - - - -	17,014 "
The summit of Little Ararat - - - -	12,951 "
The summit of Alaghes - - - - -	13,644 "

GEOLOGICAL NOTES ON A JOURNEY THROUGH THE STEPPES NORTH OF CAUCASUS, BETWEEN THE BLACK AND CASPIAN SEAS.

(*By M. von Behaghel.*)

I. FROM NEW CHERKASK, BY KACHALINSK AND ZARYTZIN, TO ASTRAKHAN.

The steppe on the right bank of the Don, from New Cherkask to Kachalinsk, is for the most part

undulating, rising in some places from 100 to 400 feet above the level of the Black Sea, according to a barometrical levelling executed along the post-road, which cuts through the steppe in a northeastern direction, rising and sinking alternately like the surrounding country. In some places, where the steppe approaches close to the Don and some little tributary streams, it is furrowed with considerable clefts and valleys. The right bank of the Don, on which, a few stages before Kachalinsk, I saw chalk, limestone, and marl alternating, and covered to a great depth with the black soil of the steppe, is, almost throughout, considerably higher than the left bank, which latter rises gradually to the steppe. On the Donetz also, where we crossed it, the right bank was, in like manner, 20 or 30 feet high, while the left hardly rose above the level of the stream.

The dividing ridge between the Volga and the Don is little furrowed on the western side, where it rises gently; towards the east, on the other hand, descending more rapidly to the Volga, it is marked by glens and by valleys overgrown with wood.

From Zarytzin, at the eastern foot of the dividing ridge, to Astrakhan, the right bank of the Volga also is considerably higher than the left; yet I saw this myself only from the fifth to the second stage from Astrakhan, while travelling on the ice of the river. From the second stage to Astrakhan the difference between the banks of the river disappears: higher up than the fifth stage I know their characters only from the accounts of the inhabitants, whom I frequently interrogated.

On the steeply-ascending right bank sand alternates with clay. The left bank, overgrown with wood and covered with snow, revealed nothing of its geological formation to a distant observer. It

appeared to me remarkable, that in the case of the Donetz, as well as of the Don and Volga, the right bank was constantly higher than the left, which rises gradually to the level of the steppe. Perhaps a more careful and minute examination of the valleys of these rivers would throw some light on the gradual subsidence and temporary suspension at various successive levels of the sea once formed by the union of the Black and Caspian Seas. My hasty journey over this country in the midst of winter did not allow me an opportunity of closer observation.

II. FROM ASTRAKHAN, ALONG THE SHORES OF THE CASPIAN SEA, TO KISLYAR, AND THENCE TO VLADIKAVKAS.

An undulating steppe of a yellowish-red sand extends far and wide for several miles on the northern side of Kislyar. It changes its surface and its look with every gust of wind, and, utterly destitute of vegetation, it presents to the eye nothing but clouds of dust, which in the dry season of the year hardly subside even when the air is perfectly calm. It is only between the third and fifth stages southward from Astrakhan that this desert is crossed by flat and slightly-depressed valleys, which open eastward towards the Caspian Sea, and contain salt-lakes. The banks and beds of these are formed of yellow-brown clay, with more or less sand; but a little higher up on the steppe reappears the same yellow-red sand, containing in great abundance the fragments of such shells as are found in the Caspian Sea.

According to the accounts of the Kara-Nogays, the Manech formerly discharged its waters into the Caspian Sea through one of those flat valleys; at present it terminates in a great lake, two days' journey from the shores of that sea. About a mile

south of the station of Beloserk we crossed a dry watercourse, which is reported to have been formerly filled by the Manech. We would gladly have traced this problematical watercourse up to the reported lake, but the extremely unfavourable season of the year (the last week in January), when snowstorms in the steppe are so frequent and so formidable, forbade our undertaking to wander over the plain for five or six days, at a distance from any roof. In like manner as the Manech, the Kuma also, which a hundred miles higher up is a considerable stream, is here, on the road, but fifteen paces wide, and loses itself in the sand before it reaches the sea.

Some miles north of Kislyar a coarse gray sand makes its appearance here and there, mingled with alluvial earth, and seems to take the place of the yellow-red sand; it has more consistence than the latter, and is, consequently, not so easily thrown about by the wind. The steppe formed by it is generally level, and in the neighbourhood of Kislyar is overgrown with bushes. From this place we cut across the steppe, in a southwestern direction, to the Kossak station of Nour, on the river Terek; the plain exhibiting no change, except in the increased frequency of dry watercourses and beds of shallow lagoons.

Near the station of Kalinovka the Terek cuts its way through the steppe with an impetuous current, and frequently changes its course as it undermines and carries off its banks in the sandy soil.

The division between the lower Terek and the lower Sunja, which at first flow down northward from Caucasus, is formed by a ridge of hills from 300 to 400 feet high, which compels those rivers to bend eastward as they descend into the plain. These hills are rounded by the action of water,

and consist of a conglomerate of shell-lime, from which here and there burst forth springs of hot water or of naphtha. This row of hills has, on both sides, the steppe, which extends even to the northern foot of Caucasus. A large portion of the steppe on their southern side is converted by the tributaries of the Sunja into a fruitful plain encompassed with woods.

The Sunja, which forms the boundary of the Russian and the Caucasian dominions, approaches close to these hills in its eastern course, and has there formed for itself, in the loose soil of the steppe, a bed from 20 to 30 feet deep, and as many paces in width.

III. FROM NEW CHERKASK TO ALEXANDROF, ON THE CAUCASIAN LINES.

At Rasdorskaya (a Kossak station about 30 miles northeast of New Cherkask), the left bank of the Don was overflowed in the month of May to the extent of several miles, so that we spent half a day in crossing that river from the elevated right bank. We passed the river Sal, which also far overspread its banks, and was not here distinguishable from the Don. We did not reach dry ground till we had arrived in the middle, between the Sal and Manech, probably on the low ridge which separates their waters. Here recommences the steppe, which we rode over in an easterly direction, on the right bank of the Manech, as far as the frontier post of Verkhnoi Kamennoi. This steppe has a width of many miles, and is as level as the sea, its aspect being varied only by kurgans (barrows or sepulchral mounds of ancient date) from 4 to 15 feet high or upward. Eight miles west of the village of Andreyefka appear the first symptoms of an undulating surface. which in the neighbourhood

of the great lake rise 100 feet and more above the steppe: these low hills are often separated by plains several miles wide. At Verkhnoi Kamennoi these hills already form connected groups, which rise 300 or 400 feet above the level of the Black Sea, and are sure not to escape observation, as the steppe so far nowhere attains a height exceeding 60 or 80 feet.

Limestone, occurring in many places, was the only rock that I found in the steppe *in loco:* it was a friable conglomerate of shells of the Black and Caspian Seas, with a covering of black alluvial soil, nourishing abundance of grasses. In the vicinity of the salt-lakes, which occur frequently in the steppe, appears reddish-brown clay, with fragments of gypsum and sandstone, and quite denuded of vegetation.

From Verkhnoi Kamennoi, 400 feet above the sea, and about 30 miles north of the Manech, the ground sinks gradually, till, at the junction of that river with the Kaláus, coming from the south, it is but 11 feet above the level of the Black Sea.

The road southward goes up along the course of the Kaláus in the bottom of the valley. The undulations are of inconsiderable height, and completely rounded off. Some miles north of Petrofskaya the sides of the valley of the Kaláus begin to rise, and a little below that village they obtain a considerable elevation: other hills are at the same time visible, extending towards the southeast, and consisting of the shell-limestone.

From this place there is a very perceptible ascent southward to the elevated steppe on which Alexandrof lies. The shell-limestone of the hills probably extends into that steppe, which seems to be exactly on a level with their summits.

GEOLOGICAL NOTES ON A JOURNEY THROUGH CAUCASUS.

I. FROM YEKATERINOGRAD TO TIFLIS.

Fifty miles southeast of Yekaterinograd we crossed over a plain watered by the tributaries of the Terek, and adorned with trees of the most luxuriant growth, till we came to a range of hills which seems to run parallel to Caucasus. These hills and valleys, alike covered with the finest timber, had the effect of surprising as well as exhilarating us, accustomed as we had so long been to the monotonous and dreary steppe. But the road gave us no opportunity of examining the rock-formations; and the traveller cannot here deviate an instant from it without the risk of being pounced upon by the mountaineers, who lie concealed in the long grass and bushes watching for prey; hence this district cannot be passed through in safety without a good military escort. The cliffs seen at a distance appeared to me to be limestone. At the southern foot of these hills begins another plain, of the same character as the preceding one, and extends to the northern border of Caucasus, which commences four miles from Vladikavkas.

The northern slope of Caucasus begins here with roundish and moderately high mountains, consisting of limestone and masses of clay state, and densely overgrown with wood; yet a few miles south of Vladikavkas these mountains rise to a considerable height, and have sharply-defined outlines. First, limestone, inclining northwestward, appears as naked rock, with a dip varying from 20° to 90°; it is followed by clay-slate, striking to the southeast, and vertical. This rock is penetrated by veins of white quartz, in which are nodules of serpentine and chlorite. Gneiss also, in large strata, alternates with

the clay-slate. In the neighbourhood of Dariel, deformed pine-trees shoot up from the clefts in the bare rock.

Between Stepan Zminda and Kobi the valley of the Terek again widens, and its sides are no longer formed by rocky precipices. Fragments of clay-slate and dark gray limestone lie on the roadside, both apparently being the constituent rocks of the adjacent hills.

About a mile or a mile and a half south of Kobi we left the valley of the Terék, and ascended southward up a lateral valley, which leads to the ridge of the Cross-Mountain. The ridge has little width in this place: to the west, and still more to the east, of the Cross-Mountain, loftier summits tower above.

On the south side there is a descent of about 100 feet before the road turns to the Gudgará, which yet is not, in strictness, separate from the Cross-Mountain, but is only an eminence of the same mountain crest. From the Gudgará we descended into the valley of the Aragvi.

Clay-slate, inclined to the northeast, makes its appearance on the south side of the Cross-Mountain. The rest is covered with dark-brown clay and fragments of basalt (like the Rhenish millstone, but with finer pores), dark-gray limestone, and clay-slate. The same basalt is found, *in loco*, on the Gudgará, on the north side of the Cross-Mountain, where there occur also, issuing from the crevices of the basaltic rocks, numerous acidulous springs.

The valley of the Aragvi is enclosed by mountains, which rise at least 1000 feet above it, decked with groups of the noblest trees, from among which here and there the clay-slate protrudes, with northwestern inclination. At the bottom of the valley are to be seen only fragments, chiefly of the clay-slate, more rarely of porous basalt.

Between Ananur and Dusheti we left the valley of the Aragvi, which turns eastward, and crossed a ridge, the northern slope of which seems to be steeper, and to stretch farther down than the southern. The rocks here disappear in the deep soil, the rounded eminences being covered with a layer of clay mixed with lime and gravel. At Dusheti only I saw on the side of a hill, beneath the stratum of clay, a crumbling and disintegrated limestone. A few miles south of Dusheti we again entered the valley of the Aragvi, and continued in it till the union of this stream with the Kur. Within this distance the valley has, in general, a width of from seven to ten miles. The bottom of it is covered with a rich alluvial soil. This is externally distinguishable from the dark soil of the steppe only by its deep brown colour. It is sprinkled over with green sandstone, containing lime, and with limestone gravel.

At Mzcheta, a good-sized village with a church, the Aragvi falls into the Kur, which from this place, till within a few miles south of Tiflis, flows close to the foot of the mountain range, which stretches from the west. Consequently, in this part of its course, the right bank is generally steep, and divided by numerous glens and branches, particularly near Tiflis, where this range of hills attains a height of 2300 feet, and about four miles farther west a height of 4500 feet. The rocks here found are,

1. Green sandstone, containing lime, and predominating as far as Tiflis. Its inclination is to the north, though in a few places to the south. It forms strata from an inch to a foot in thickness, and when weather-worn breaks off in thin flakes.

2. Dark-gray lime, alternating with the sandstone. It lies in thinner strata than the latter rock, and when in a state of decay falls to pieces with a

fascicular appearance. Three or four miles southwest of Tiflis this rock occurs, bearing impressions of fish.

3. Porphyritic greenstone, passing over into the amygadloidal kind. At the south end of the town it takes the place of the stratified rocks, and is crossed in various directions by veins of calcareous spar.

4. Clay-slate, with north-northeastern inclination, in a little lateral valley of the Kur, near Tiflis, and beneath the greenstone porphyry. From this rock issue the hot springs which supply the well-known baths in Tiflis.

5. Seams of stone-coal, from an inch and a half to three inches in thickness, are found in a glen at the southwestern end of the town, between the strata of green sandstone. Where the rocks here mentioned are not laid bare, the ground is covered with gravel and alluvial soil.

II. FROM TIFLIS, THROUGH KAKHETIA, TO THE SOUTHERN FOOT OF CAUCASUS.

A PLAIN, traversed by shallow depressions and valleys, extends twelve miles east-northeast from Tiflis, till it meets with a range of hills. It is formed throughout of disintegrated limestone, covered with a dark-brown alluvial soil, like that in the valley of the Aragvi. The rounded hills at its termination, stretching from northwest to southeast, and of moderate elevation, form the line of separation between the Kur and its tributary the Yora. The rock of which they are formed shows itself at only a few points—the greenish-gray sandstone of Tiflis, with northern inclination, protruding from a great stratum of calcareous conglomerate. There is no tree to be seen in all this tract.

Northeast of the row of hills, another plain, of the same character as that above described, and

2080 feet above the sea, extends to the Yora. This mountain stream has here worked itself a bed fifty or sixty paces wide, in the loose, gravelly soil, composed of Tiflis sandstone, limestone, and yellow-brown clay. It is said to change its bed considerably every spring. On the left bank of this river commence the projections of a southern ramification of Caucasus, extending towards the southeast. This range of mountain is almost totally covered with lofty forests; hence such a view of their outlines as would enable us to recognise their mineral conformation is not to be obtained. Only here and there, mountain peaks, or naked, rocky cliffs, are exposed to view, in such a way as to form with the groups of trees, lively rivulets, and cascades, the most charming landscapes. Such is the case at Gambori, a fort in the heart of the mountain, 3350 feet above the sea. The highest point on the old road from Gambori to Telavi, and belonging to this range, has an elevation of 5100 feet. Here, as well as in the still more elevated environs, there is nothing to be seen but gravel, such as is found in the valley of the Yora. In some places, the rivulets, undermining the mountain sides, have caused slips, which expose the gravel to the height of 100 feet.

Between Telavi and Yenisseli flows a lively mountain stream, the Alasani (a tributary of the Kur, northeast of the Yora, and parallel with it), through a valley from twelve to twenty miles wide, the bottom of which is about 850 feet above the sea, and is covered with alluvial soil, like the valley of the Aragvi. The bed of the river and its immediate vicinity are covered with gravel, chiefly of limestone, clay-slate, and also quartz, which is mingled with chlorite, and contains iron pyrites, sometimes passing into brown iron ore. It is said

that gold was formerly obtained from the sands of this river.

From the village of Yenisseli we made an excursion into Caucasus, in the country of the Lesghians. Through close glens and up steep mountain sides, between oaks, beeches, and other trees, which, from the size of their trunks and their towering height, may be conjectured to have flourished many centuries, a narrow path leads to the rocky point of Sakoris-tzveri, 10,000 feet above the sea. This is one of the peaks of the ridge of Caucasus. Its summit has but little extent, rather sharp and pointed than rounded off, and is formed of clay-slate, with southeastern inclination, and here with but a scanty covering of moss and herbage. On the sides and at the foot of the mountain there are but a few spots where the clay-slate is disclosed, passing into writing slate, and traversed by quartzose veins. In a glen at the foot of the mountain lie fragments of a partially cellular quartz, with brown iron ochre and chlorite sprinkled through it, like the auriferous quartz of Ural. It was this rock, probably, that furnished the gold sand of the Alasani, in which I found quartzose gravel of a similar character.

III. FROM TIFLIS TO REDOUTE-KALEH, ON THE SHORE OF THE BLACK SEA.

From Tiflis to Suram our road lay on the left side of the valley of the Kur, through its lateral valleys, and across the hills between them. At this side of Suram we passed over the mountain range, a southern branch of Caucasus, which divides the waters flowing westward to the Black Sea and eastward to the Caspian. We thence reached Kutais, where we crossed the Rion, flowing from north to south; and lower down, where

it flows westward, our road to the coast lay parallel to its course.

About two miles north of Mzcheta we travelled across a valley ten or twelve miles wide, with a level surface and very productive soil, elevated 1562 feet above the sea. The sides of the valley seem from a distance to be rounded and covered with wood. Though the mountain stream here was inconsiderable in winter, yet its floods in spring must be enormous, for trunks of trees, carried by the waters, were to be found at the distance of a mile or two from the bed of the river.

The range of mountains at Suram, 2960 feet high, has nothing in its form to strike the eye; yet it is interesting, as forming a demarcation of climate and seasons. The eastern side of Suram, 2260 feet above the sea, has a rapid ascent, but towards the west it slopes gradually, till, at the distance of 25 or 30 miles, it forms a plain about 400 feet high, which thence sinks to the seacoast by a succession of sudden falls. The eastern side of the ridge has the northern character, firs, pines, and snow a foot deep; on the western side flourishes the vine, with grapes in December, climbing round magnificent oaks and beeches. The laurel and box-tree ar here abundant.

Limestone, greenstone, greenstone porphyry, and granite were recognised in the mountains, but their position could not be traced. The greenstone porphyry, which extends chiefly on the western slope of the range, is lost about 35 miles east of Kutais, where a white limestone, with southeastern inclination, is the only rock that remains visible for some distance, till at length it is also covered to a great depth by a dark brown alluvial earth, which forms a remarkably fertile plain, with an undulating surface.

A few miles east of Kutais the country again grows hilly. Viewed from the higher points, the whole tract as far as the coast of the Black Sea appears to be a uniform level, here forming one continuous garden, with vineyards and orchards mingled together. Unfortunately, this garden, which seems to be in perpetual bloom, is frequently exposed to great inundations; for the numerous rivers and streamlets intersecting it, when swelled by the continuance of heavy rains, which are here not unusual, or when driven back by storms from the sea, quit their beds, and overspread the plain so as to form at times an extensive sheet of water, with trees and islands rising from it, at a distance of 15 or 20 miles from the coast. Hence arise pools and marshes, which infect the air and render the climate unhealthy.

At a little distance from Kutais I again saw, on the banks of a little rivulet, naked limestone rock, covered with the foliage of the vine, the ivy, and other plants. Where this limestone is weather-worn and disintegrated, nodules of chalcedony and hornstone may be found. In the town of Kutais the Rion flows through a chasm about 35 feet deep in the same rock. From this town to the Black Sea, a distance of 80 miles, the same river has a fall of 400 feet.

A few miles west of Kutais the limestone disappears, and bright yellow or brown clay is alone to be seen, until within 20 miles of the coast, when fragments of limestone, chalcedony, and hornstone again make their appearance on a range of hills connected with Caucasus. From Redoute-Kaleh to Poti the coast is quite flat.

GEOLOGICAL NOTES ON A JOURNEY FROM TIFLIS TO ARARAT.

From Tiflis as far as the mountains of Alaverdi, the country is varied with low hills, separated by wide valleys, and covered with alluvial soil, just like the valley of the Aragvi, but with this difference, that here there are no trees visible from the road, except the few which are planted in the villages.

The right side of the valley of the Kur, consisting of porphyritic greenstone and lime, is, within the distance of eight or nine miles south of Tiflis, considerably higher than the left bank; for the latter forms only low, rounded hills, while the former rises into an elevated range.

Between Teleti and Kodi (the first and second stations south of Tiflis) those low hills are divided by a valley from 200 to 300 feet deep and a quarter of a mile wide, which contains a salt-lake half a mile long, with banks formed of sand and clay, almost wholly without trace of vegetation. Higher up, on the left side, greenstone porphyry is found in its original situation: on the right are only clay and gravel. South of this valley the country resumed its former appearance: ranges of mountains were visible only in the horizon; in the foreground were nothing but low hills, with dry grass and bushes. Five miles south of Kodi I found, at the depth of only six inches under the soil, limestone rock, passing into chalk, and containing flints; the debris of porphyry and basalt also lay scattered around.

From this quarter there is a very gentle inclination of the ground to the Alghet, an affluent of the Kur, of inconsiderable breadth, depth, and fall in September; yet the quantity of gravel, porphyritic

and limestone, heaped along its banks, show that its floods in spring must be extremely violent. Beyond that stream the ground rises again gradually to a rounded ridge of hills, which separates the Alghet from the Khram, another affluent of the Kur, running nearly parallel with the Alghet, and about 1000 feet above the sea. The valley of the Khram is a mile or two wide, not quite so flat as that of the Alghet, the right bank rising considerably higher than the left. At this time of the year (September) the river was far from being able to fill its wide bed, and in consequence it was divided into several branches, which in some places united. In the bed of the river was a great quantity of gravel and rolled stones, chiefly basalt and porphyry. From the ridge bounding the valley of the Khram on the right the ground again declines to a valley near Shulaveri, where night interrupted our observations.

At Shulaveri, on the high offshoots of the Alaverdi, granite of a fine-grained description and porphyry were found in their original situation. Higher up, porphyry and greenstone still occasionally protrude through the incumbent gravel. Before reaching the principal ridge of the Alaverdi, we passed, about two miles south of Sametzk, through a deep and narrow glen, shut in on all sides by high mountains; thence we ascended, through porphyry of various colours, to the highest ridge of the Alaverdi or Agsböük, 5780 feet above the sea. The ridge is here, on the highest part of the road, about 100 paces broad, and presents to view a number of scattered knobs of porphyry and greenstone, the latter with northern and northwestern inclination. Looking northward from this point we saw the whole chain of Caucasus, a sea of clouds overspreading and concealing

the broad tract of country between the two ranges. Numerous mountain peaks rose from this sea, like islands or promontories.

The slope southward to the station of Agsböük, a mile from the summit and 5236 feet above the sea, is much more rapid than that towards the north, yet it soon meets the plain separating Alaverdi on the north from the Besobdal Mountain on the south. The rocks are here concealed under a deep covering of alluvial earth. The northern side of Alaverdi is clothed, as far as the eye can reach, with thick forests; the southern side is without a tree.

This plain, about two miles wide at Jallal-Oglú, and nearly 4500 feet above the sea, is traversed by a chasm about a hundred paces wide and 200 feet deep, through which flows the river Tabedáh, a tributary of the Pambak, on its left. The sides of this chasm are formed of basalt, with which is found, in its original position, a porphyritic rock, generally much decayed.

Not far from the right or southern side of this chasm the ground begins to rise, at first gradually, but afterward more boldly, till it reaches a height of about 5000 feet, forming a northern ramification of Besobdal. This also is covered with gravel and alluvial soil, from which greenstone only here and there protrudes. In uniting with Besobdal, this mountain forms a basin, about a quarter of a mile wide, and half open, from the sides of which issue the springs of the river Gerger, a tributary of the Tabedáh. As to the mineral constitution of the basin we had no opportunity of ascertaining it.

From the south side of this hollow rises the main ridge of Besobdal, in steps, to the height of 6636 feet, of dark-coloured greenstone, like jasper, in thin strata, with northern inclination, and penetra-

ing the porphyry. From the narrower ridges project here and there points of feldspath and porphyry. The southern slope, which we followed along a lateral valley to the Pambak, does not differ much from the northern in degree of inclination: greenstone and porphyry throughout project occasionally from the covering of coarse shingle and gravel. A few miles from Kishliak acid springs gush forth from the middle of the road, 4960 feet above the sea. Besobdal is clothed with wood both on the north and south.

The valley of the Pambak, which has at Kishliak an elevation of 4516 feet, separates Besobdal from the mountain of Pambak, and winds among rounded hills, which are divided by lateral valleys into so many groups. These are covered with clay and gravel: now and then may be discovered a porous mass of compact volcanic ashes, of a dark-green colour, friable, sharp to the touch, and enclosing single crystals of vitreous feldspath.

The Pambak range rises to the height of 7776 feet, with steep sides. Debris of limestone and greenstone seem to be mixed abundantly with the alluvial soil that covers it. From its narrow ridge shoot up peaks of granite.

On our return from Ararat to Tiflis we crossed Pambak by a road a couple of miles east of the former one, and 300 feet higher. Here we saw on the steep flanks of the mountain greenstone and limestone of various colours, with northwestern inclination.

From the southern foot of Pambak we descended into a wide plain, which embraces the valley of the Araxes. On its right Alaghes rises to the height of 13,522 feet above the sea, crowned with perpetual snow, steep towards its summit, which is formed by a number of abrupt points. These,

viewed from Ararat, appear to enclose a hollow, probably the crater of a volcano of the early world. The southern foot of Alaghes consists of basalt; the character of its rocks above remained unknown to me. On the left side of the plain are seen a branch of Pambak and the mountain ranges, encompassing Lake Gokchai. Both advance occasionally into the plain, where they terminate in isolated hills.

And here, too, as in the plain between Besobdal and Alaverdi, is a chasm about 100 feet deep, in which flows the river Abaran or Karpichai, taking its course to the Araxes. But in summer this rapid stream never reaches the Araxes, its waters being all drawn off by canals to irrigate the plain. On the surface of the plain lie scattered fragments of limestone, greenstone, and obsidian: lower down in the soil is found, frequently in large quantities, as far as the valley of the Araxes, but without much affecting the form of the ground, a trachytic rock resembling lava.

While still two days' journey north of Echmiadzin, in the valley of the Araxes, we were saluted by the silver head of Great Ararat; yet the venerable form was revealed to our eyes for only a few minutes, a thick curtain of clouds again concealing it. It was three days afterward that we were agreeably surprised, when, walking early in the morning before the walls of the monastery of Echmiadzin, we saw the mountain in its whole magnitude and sublimity. Great and Little Ararat, with a part of Aladagh, formed together a very peculiar and impressive picture.

The extensive plain, forty or fifty miles in width, round Ararat, is formed, in some measure, by the expansion of the valley of the Araxes, which, commencing a few miles east of the salt-mines of Kulpe, is said to terminate in a wide sweep southeast of

Little Ararat. It is almost a dead level throughout, except within a few miles northwest of Great Ararat, where trachytic rock extends far across the plain, as if poured down from the mountain; and again, northeast of Ararat, close to the Araxes, and in the midst of low marshes covered with reeds, there are several little hillocks, 30 or 40 feet high, like islands, and formed of dark-gray limestone with white veins. The soil of the plain, in general, consists of sand and alluvial earth; in the neighbourhood of Ararat, merely of sand of disintegrated trachyte. Wherever alluvial earth and sand form the superficial stratum, the soil seems capable of cultivation, though little used for that purpose. In some places it is completely bare; and there, in the dry season, it is whitened by the efflorescence of muriate and sulphate of soda. The Araxes was nearly dry in September, being exhausted by the numerous canals of irrigation.

On the northern face of Ararat, the first thing that strikes the eye is a deep and wide chasm, which seems to disclose the interior of the mountain. It begins near the summit with a soft depression, which, growing deeper as it descends, and continuing in the same direction, forms, at length, a profound glen with precipitous sides, which are themselves rent and split in a thousand forms. Such is the character of the great chasm about a mile above the monastery of St. James. Near the monastery it widens considerably, and escapes, in some measure, from its rocky barriers. Half a mile lower down it branches into a number of shallow depressions, which lose themselves in the plain of the Araxes.

The immense fragments of rock, ten or twelve feet in diameter, which are heaped together in the bottom of this chasm, offer unequivocal proof of

the terrific force of the floods, which roll down here from the melting snow in spring, and also show the perpetual destruction going forward in the higher regions, which, indeed, is announced almost every minute by low, murmuring sounds from the rocky steeps and cavities above; yet, in October, the rivulet here is very inconsiderable.

In the course of an excursion up the great chasm, I was surprised at the sight of a mass of ice thirty or forty feet in thickness, in a cleft between loose fragments; and on farther search I found many similar walls of ice, which convinced me of the presence of a glacier. This extends, with little interruption, from the region of snow down to within about a mile of the monastery of St. James. It fills the chasm completely where the sides are steep and close; otherwise it clings to the western side. The lower end of the glacier is covered to a great depth with stones of every size: these piles exhibit fantastical and rugged outlines, which are continually changing, owing to the melting of the ice beneath.

In some of the hollows of those heaps of stones, sulphate of alumina effloresces so as to form here and there a coat of some lines in thickness. Pieces of the trachytic rock may be found here, covered with vitrified and common opal. If Great Ararat be supposed to have had a crater, this chasm may be considered as its remains. It originated, probably, in the sinking or falling in of this side of the crater.

The east, south, northwest, and southwest sides of Great Ararat are also deeply marked by numerous clefts and chasms, some beginning near the summit, others lower down, and sometimes uniting together to form one great furrow, extending down to the plain. Grassy plains, a quarter of a mile wide

occur at a considerable height on the northern and northwestern side of the mountain; but below they are almost always bounded by heaps of loose stones and rocks, 100 feet or more in height, and resembling the accumulations at the feet of the Swiss glaciers called *moraines*. Similar heaps, though of greater magnitude, extend from the northwestern and southeastern feet of Great Ararat into the adjoining plains. These appear to me to be streams of lava decayed and broken.

The rock of Ararat breaks, in general, in masses of from ten to twelve feet in diameter. It is a trachyte of a gray or reddish colour, dense or porous, with more or less vitreous feldspath. On the northern side is found pumice, much decayed; on the southwestern side, obsidian.

GEOLOGICAL NOTES ON SOME EXCURSIONS ROUND GREAT ARARAT.

FROM ST. JAMES TO THE SALT-WORKS IN KULPE.

For ten miles we followed a northern direction, in order to clear the above-mentioned streams of lava. Having arrived in the open plain of the Araxes, we turned westward, and so reached Kulpe. Throughout this distance the plain maintains the character which we have already given of it. The projections of Aladagh are formed of fragments of trachytic rock, and these heights in the distance are the only points which catch the eye. Looking back, we see Ararat steeper in its outline than before, but still forming a blunted cone, much marked on its western side by jagged rocks and abrupt steeps. About twelve miles from Kulpe, when we came upon higher ground, the irregular heights in the neighbourhood became

visible. Here, also, the valley of the Araxes was much narrowed, and it soon lost its expansion altogether, the stream winding in a bed enclosed by high cliffs.

The covering of many of the heights near Kulpe is a dark red and yellow clay, which, being completely destitute of vegetation, had pealed off at this dry season in little scales and round pieces.

The great mass of salt, which for 600 years has supplied all the country round about, and still seems inexhaustible, is situate in a mountain not differing materially in form from those around it. Its summit is of considerable extent, flat, with roundish and funnel-shaped depressions, which have probably arisen from the falling in of galleries. Its surface is covered with yellow and red clay, alternating with gypseous strata of very variable thickness.

Half way up the sides, which are generally steep, are opened galleries; and frequently it is enough to penetrate through only a few feet of clay or gypsum in order to reach the white stone-salt which intersects these strata in all directions, and with the most varying conditions of breadth, height, and depth.

FROM ST. JAMES'S TO BAYAZED.

At first our road led us westward, over rocks and through narrow passes along the skirts of Great Ararat. We then made a circuit to the south in order to avoid the high ridges, and directed our course by the southern foot of the mountain to a level plain of several miles in extent. On the north it was bounded by Aladagh; on the south and west by the branches of Taurus, which separate the sources of the Euphrates from those of the Alsas; on the east it appears to unite with the ex-

pansion of the valley of the Araxes. This plain, which we crossed in a southern direction, was covered partly with sand, partly with alluvial earth, and exhibited cracks, some inches wide, in all directions — the consequence of the continued drought. From this southern point of view Ararat appears more perfectly conical than from the north. Its western side ascends in a succession of terraces to the summit, the highest point of which, forming a small cone, is at the eastern end. Thence the slope downward to the east is uninterrupted, at first bold, then more gradual, to the ridge connecting Great with Little Ararat.

Before reaching Bayazed we had to wade through the Alsas, which winds across the plain in a bed fifteen or twenty paces broad and about two feet deep. Before us rose Agridagh, steep and abrupt, with numerous deep fissures and craggy ridges, on which I found nothing but compact limestone, white and reddish-brown. The vicinity of Bayazed had a desolate and dismal appearance, not a single tree being visible.

We were obliged to abandon our plan of examining the country round Bayazed, and thence to the southeast and east of Ararat, on account of the Kurds, whose incursions kept the town in continual alarm. A short time before they had even made an attempt to retake it from the Russians.

FROM ST. JAMES'S TO THE MOUNTAINS NEAR LAKE GOKCHAI.

We crossed the plain of the Araxes in a direction due north from Great Ararat, avoiding the villages as much as possible, the plague having raged violently in them a few weeks before. Viewed from the plain, the southern face of the mountains round Lake Gokchai seemed split into numerous projecting branches, with serrated and conical sum-

mits, particularly towards the southwest, and of reddish-brown or yellow colour, probably trachytic rock, or, perhaps, clay. In a day and a half we reached the foot of the mountain. Here we were obliged to visit the nearest village, in order to obtain some precise information respecting the situation of an Armenian monastery, called Kegartha, for it was of the first importance to us to find a secure and hospitable place of abode, the mountain being occupied almost wholly by predatory Tatars; besides, our expectations were raised to the highest pitch respecting the monastery, which was reported to be of the most singular construction, since not only the church, but dwellings for the ecclesiastics also, were all hewn out of a single rock. The guide, whom we took with us from the village, led us some leagues into the mountains. At first the prevalent rock was a greenish-gray sandstone, with very variable inclination, occasionally showing itself through the superincumbent clay and debris. Our path at times crossed large tracts covered with vestiges of destroyed dwellings, and one ruin was found of a building raised wholly with squared stones.

We were hoping at every turning of the path to see the monastery, when, on a sudden, our guide ran off. In this labyrinth we could never expect to catch him, whatever pains we might take; yet, after we had wandered about for some hours in the mountain, where I saw no rock but basalt and dolorite, accident presented us with a second guide. With him we toiled, in every variety of direction, over rocks and through defiles, till at length we came to a chasm, 50 or 60 paces wide, where I was surprised by the sight of a group of upright basaltic columns, and also of an arched group; and still more was I astonished to see here an arched bridge

of squared trachyte and basalt, built over the lively stream that hurried down among the rocks. In this interesting spot we determined to rest a few minutes. I looked out for a good point from whence I might make a sketch of this romantic landscape. I had scarcely drawn the outline, when I saw the guide running as hard as he could, and soon after climbing over a distant rock, so that it was impossible now to overtake him. There was no chance, therefore, of our seeing the monastery. We could not think of advancing farther into the mountains, for it was only on this side of the bridge, on the left of the torrent, that a path was discernible; on the other side, the shattered fragments of rock strewing the surface offered no track to guide us.

It was not until the next day that, after much fatigue, we reached Erivan. In all this tract I saw no rock but basalt and trachyte: the heights are generally covered with a productive alluvial soil. The Sanga, at Erivan, flows through a chasm, in basalt, 100 feet deep, just like the Karpichai at the eastern foot of Alaghes, and the Tabedah between Alaverdi and Besobdal.

APPENDIX.

(BY THE EDITOR.)

APPENDIX.

LEVEL OF THE CASPIAN SEA.

It will have been seen, from the scientific papers subjoined to M. Parrot's narrative, that he attached much importance to the determination of the relative levels of the Black and Caspian Seas. His barometrical observations made between those seas, in conjunction with Dr. Engelhardt, in 1811, seemed to confirm the prevailing opinion respecting the great depression of the Caspian; but numerous considerations led him to doubt the correctness of that result. The magnanimity which he exhibited in questioning, in this instance, the sufficiency of his own labours, is justly appreciated by M. von Humboldt, who says:*

"M. Parrot, the premature loss of whom is to be deplored by science, conceived, during his memorable journey to Ararat, doubts respecting the correctness of the two barometrical levellings by stations, which he had executed in 1811 with the greatest care, though labouring under tertian fever. He had the courage to repeat this laborious task in 1830, for twelve days, between Astrakhan and New Cherkask; and from this operation he concluded that 'there exists but little difference between the levels of the Black and Caspian Seas.' It is impossible to praise too highly the strictness and noble candour with which M. Parrot discussed his own barometrical observations. He showed himself to be constantly guided by the love of truth."

* Asie Centrale, tom. ii., p. 305, 306.

Not only did M. Parrot assist in developing the objections to the results of his own hypsometrical labours; he proposed, also, a system of operations calculated to detect the source of error, and urged the utility of such research. The advantage of solving an important problem of physical geography connected with the depression of Central Asia was at length recognised by the Imperial Academy of Sciences of St. Petersburg, and under the auspices of that learned body, MM. Fuss, Sabler, and Sawitsch proceeded to execute a trigonometrical levelling of the country between the Black and Caspian Seas. Their operations, which consumed nearly a year and a half, terminated on the 23d of October, 1837. The definitive result of their measurement was, that the Caspian is 83·6 English feet below the level of the Black Sea.

A French gentleman, M. Hommaire de Hell, who travelled in the Caspian steppes in 1843, and executed a complete levelling between the two seas, reduces the depression of the Caspian to little more than 60 feet. He will hardly succeed, however, in shaking the authority of the Russian mathematicians, whose calculations, moreover, were revised by the distinguished astronomer M. Struve.

It deserves to be remarked, that the results of barometrical observations made at the shores of the two seas agree in the mean tolerably well with those of the geodetical operations, whereas a barometrical levelling by stations made in 1838 again gave for the Caspian Sea a depression of 300 feet. This is attributable to accumulation of errors, the result in station-levelling being arrived at by taking the sum of many observations.*

* Humboldt, Asie Centrale, tom. ii., p. 307; M. Lenz, in the Bulletin Scientifique de St. Petersburg, tom. i., p. 2 and 51

PARTIAL FALL OF ARARAT.

In the summer of 1840 Armenia was visited by a violent earthquake, which shook Ararat to its foundation. The immense quantities of loose stones, snow, ice, and mud then precipitated from the great chasm immediately overwhelmed and destroyed the monastery of St. James and the village of Arghuri,* and spread destruction far and wide in the plain of the Araxes. Although Ararat is formed of volcanic rocks, yet no allusion to its volcanic activity at any period, no mention of an eruption, is made by any of the native historians, who record, nevertheless, several earthquakes more or less calamitous. Reineggs, the German traveller, alone bears witness to the active fires of Ararat. When seeking to explain the symptoms of igneous action on Caucasus, he says:

"Some distant southern volcanoes, or Ararat itself (the terrible gorge of which, distant from Caucasus in a straight line 150 miles, one can hardly look at without shuddering, and which, on the 13th of January and 22d of February, 1783, began again to throw out smoke and fire), must have burned the top of Caucasus, and thrown upon it those mineral ashes."†

* The name of this ancient village, the church of which was founded in the latter half of the seventh century, is, according to M. Brosset (Bulletin Scientifique de St. Petersburg, tom. viii., 41), correctly written Acorhi or Acourhi. He rejects, of course, its supposed derivation from the words *Arc ourhi*, "he (Noah) planted the vine."

† Description of Caucasus (in German), St. Petersburg, 1796, vol. i., p. 28. Reineggs is treated contemptuously by Carl Ritter (Erdkunde, vol. vii., p. 507), who completely perverts the traveller's statement, taking it perhaps at second hand, for Reineggs nowhere says that he saw the eruption of Ararat from a distance of 150 miles. But the following note of Schröder, who edited Reinegg's MSS., on the passage given above, is more deserving of attention:

The fact thus related is denied by Sir R. K. Porter,* who concluded that because the monks at Echmiadzin in 1817 had no knowledge of an eruption of Ararat in 1783, no such eruption could have taken place. But it may well be doubted whether an inference of so positive a kind can, under all the circumstances, be fairly drawn from merely negative evidence. Were it once admitted that the volcanic fires of Ararat were rekindled in 1783, then that mountain might be naturally assumed to be the centre whence proceeded the violent commotions which have recently afflicted Armenia.

The earthquake of the 20th of June, 1840, was first felt in the vicinity of Ararat, about forty-five minutes past six o'clock in the evening, and continued with alternating shocks and undulatory motion of the earth for two minutes. The monastery of St. James and the village of Arghuri, with the summer residence of the sardar, were all buried in the ruins from the mountain. The streams of mud and melted snow poured down from the great chasm, covered the fields and gardens to the distance of seven miles. The first four shocks, which were the most violent, and were accompanied with a low subterranean noise, seemed to proceed from Ararat in an east-northeast direction, and left on their way traces of terrible violence, particularly in the circles of Erivan and Nakhichevan.

About seven o'clock the same evening above 3000 houses were thrown down in the district of

"Should the magnificent collection of paintings of Prince Potemkin or of Count Stroganoff be ever opened to the public, no one will then be astonished at seeing smoke and fire issuing from Ararat. In this state Reineggs, and also the engineer and artist who were travelling with him, saw it for three days long. As there was no tradition or historical record of a volcano on Ararat, the country around was filled with terror."

* Travels in Georgia, Persia, &c., vol. i., p. 185.

Sharur, on the Araxes, east of Ararat. About the same time the shock was felt at Shusha, in the province of Karabagh, and farther off, towards the northeast. There the convulsion seemed to last a minute, and much damage was done. Towards the southeast, down the valley of the Araxes, shocks were felt as far as the province of Talyshin, on the shores of the Caspian Sea. Northward, and beyond the valley of the Araxes, at Gumri and Tiflis, the earthquake was about the same time perceptible, but not destructive.

It was in the valley of the Araxes, near the Karasu, or Blackwater, and at the mouth of the Arpachai, that the violence of the earthquake was most severely felt. The banks of the Araxes gaped in cracks 10 or 12 feet wide, parallel to the course of the river, and to the distance of a quarter of a mile from it. These fissures threw out water, with great quantities of sand, to the height, in some cases, of five feet. The bed of the Araxes was in some places left quite dry; in others, the collected waters were kept in continual agitation as if they boiled.

This terrible convulsion was felt also south of Ararat: in Maku and Bayazed many buildings were thrown down, and shocks reached even Tabreez, east of the lake of Van. But the chief sufferers were the inhabitants of Armenia. Of the population of Arghuri, estimated at a thousand souls, not one escaped. In the town of Nakhichevan nearly 800 houses and other buildings were destroyed. Erivan suffered in like manner; and throughout the villages the habitations laid in ruins amounted to between 6000 and 7000. Had not the earthquake taken place at the hour when the Easterns generally quit the shelter of their roofs to enjoy the freshness of the open air, its effects would have been much more fatal; but it does not

appear that above 50 people (exclusive of those who perished on Ararat) lost their lives on the occasion, buried in the ruins of their dwellings.

Shocks were felt daily in the villages near Ararat till the 26th of June, each continuing about two or three minutes. It was on the 24th that the great fall of Ararat, as it has been called, took place. At the commencement of the earthquake, the monastery of St. James and the village of Arghuri were at once buried beneath the rocks, ice, and torrent of mud which fell from the great chasm above. But as the ice and snow precipitated from the summit gradually melted, the whole mass lost its stability, and about nine o'clock in the morning of the 24th it began to move with extraordinary rapidity down the mountain towards the Karasu, so that in an incredibly short time this stream of rocks and mud spread to a distance of 12 or 14 miles in the valley of the Araxes. The debris of the trachyte, imbibing water, formed a blue mud, which poured down in a stream 80 or 100 feet deep in some places, and seven miles wide. About the 5th of July it ceased to flow, and soon afterward dried completely.

The result of this fall has been a vast increase in the size of the great chasm, from which the accumulations of rocks and ice made during ages have been swept away. The snowy summit of Ararat has sunk considerably, but has not fallen in, as was reported. The white, yellow, and vitreous feldspaths, with crystals and pyrites, which seem to form the heart of the mountain, are now fully exposed to view on the upper walls of the great chasm.

Of the monastery of St. James not a vestige remains. The meadows round it, where thirty families of Kurds, encamped there at the time of the

earthquake, perished, are now covered deeply with the deposite of mud. At Arghuri some of the dwellings have been cleared by the Kurds seeking for treasures. They are found to be completely filled with mud and rubbish; and from the condition of their side walls, compared with that of their roofs, it may be concluded that they were overwhelmed and crushed from above.

THE END.

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